REVEAL
NEW ECOLOGIES FOR AN URBAN STREAM SYSTEM

by

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A REPORT

submitted in partial fulfilment of the requirements for the degree

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Abstract

Throughout the history of Kansas City, the Brush Creek Corridor has experienced severe flooding which, on numerous occasions, has resulted in loss of life. This urban stream supports a high profile area of the city. It is located adjacent to what is considered Kansas City's most elite shopping district, the JC Nichols Country Club Plaza, the University of Missouri - Kansas City urban campus, as well as numerous high density residential units.

The stream corridor has been confined due to the encroachment of the surrounding urban environment which has minimized many opportunities for the future management of Brush Creek. There have been many flood control projects but these solutions have not been effective in reducing along the entire corridor. Previous projects have been done in a way that alienates urban dwellers from Brush Creek and does not allow pedestrians to utilize the stream corridor as an effective urban green space.

The Brush Creek Corridor can be redesigned to revitalize the existing area by embracing natural ecological processes in order to create a more sustainable urban stream system. Brush Creek can be envisioned in a way that will enhance visitor experience by exposing and revealing the ecological processes to the users without inhibiting the functionality of those natural processes.

Four project goals have been identified through research: improve, connect, and educate. In order to achieve the project goals, a set of sites are to be selected from the corridor. A corridor study is done to identify sites by assessing factors related to the site's ability to improve, connect, and educate. Once the sites have been identified and defined, programming and site design strategies will be implemented to relate to the project goals.

The selected sites within the Brush Creek Corridor will be models for experience oriented urban stream design. The project area will harbor healthy ecosystems with integrated pedestrian oriented spaces that connect the corridor, improve environmental conditions, and support environmental education. These projects will be catalysts for experience oriented ecological design solutions throughout the Brush Creek Corridor in the future.

REVEAL

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urban stream corridor

brush creek
kansas city . missouri

acknowledgments

I would like to thank my major professor Lee Skabelund for all the hard work, time, and dedication put into the development of this project. To all of my studio brothers, thank you for all the fun times, and may they continue. I would also like to thank my mom and dad for all the love and support throughout all the years gone by and all the years to come. Most of all I would like to thank my big brother Kiley for showing me how precious this life is. I have learned from him to live in the moment, and that no matter what happens, where you are, or who you're with, do what makes you happy.

To my big brother, Kiley. Everything I do is for you.

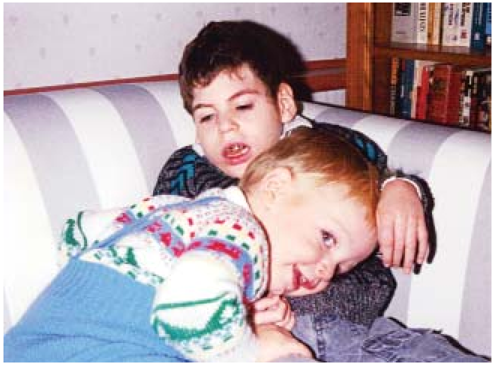


table of contents

image source (Charles McDowell)

figures

introduction

description . intent

description . intent cont.

precedent study

inventory . analysis

design solution

design solution cont.

conclusion

appendix

introduction

image source (Charles McDowell)

the urban stream dilemma

In the recent history of urban development, the development and management of streams and stream corridors has neglected natural processes. Streams have been managed as infrastructure not to be seen by the public eye.

Management strategies have emphasized flood control, erosion protection, and public disconnect. These development trends have created communities which are physically separated from their waterfronts, either by physical infrastructure, such as highways, or by the industrial uses and utilities that frequently line and isolate the waterways (Rhodeside & Harwell Incorporated 2006, 4).

The historic approach to flood control has left streams and rivers straightened, deepend, and stripped of vegetation and natural character (Rhodeside & Harwell Incorporated 2006, 4). Four major impacts are seen in urban streams and rivers caused by the current management process: physical, chemical, biological, and social.

At the root of the urban stream dilemma is the conflict between two processes: **the hydrologic cycle** and **urbanization**. An understanding of these processes and relationships makes it possible to manage streams in a way that is environmentally sensitive and aesthetically satisfying (Rhodeside & Harwell Incorporated 2006, 4).


figure 1.1: concrete lined channel - Brush Creek (Charles McDowell)


figure 1.2: urban pollution - Brush Creek (Charles McDowell)


figure 1.3: concrete waterfall - Brush Creek (Charles McDowell)

the hydrologic cycle

A basic understanding of the hydrologic cycle is necessary to make connections between urban stream systems, the impacts of urbanization on stream systems, and management practices that will mitigate those negative impacts. Connections can be made from the concept of the hydrologic cycle, urbanization, and the current conditions within the Brush Creek Corridor.

When understanding the hydrologic cycle in relation to Brush Creek, it is important to understand the concept of a watershed. A watershed is the area where natural drainage patterns convey surface water flows to a low-point destination (City of Los Angeles 2007, G5).

The hydrologic cycle describes the ways in which water moves around the earth (Dunne 1978, 4). This process has no beginning or end, as it is a cycle, but when looking at the cycle in relation to Brush Creek, precipitation is the start. When water falls to the earth as precipitation, it is either caught by vegetation, absorbed by the soil, or remains on the surface of the ground, running down slope as surface runoff. The absorbed water infiltrates into the soil and is either held as soil moisture or percolates through the soil as groundwater. Water moving overland, or as groundwater eventually flows to the lake or stream in the watershed (Dunne 1978, 4-5).

Key Terms:

Watershed - the topographic divide separating one drainage basin from another. A watershed may be defined as the area within which natural drainage patterns convey surface water flows to a specific low-point destination (City of Los Angeles 2007, G5).

Precipitation - water released from clouds in the form of rain, freezing rain, sleet, snow, or hail. It is the primary connection in the water cycle that provides for the delivery of atmospheric water to the Earth (US Geological Survey 2011, The Water Cycle).

Surface Runoff - surface discharge in the form of overland flow and channel flow (Marsh 2005, 425).

Infiltration - ground material takes in water through pores in the surface (Marsh 2005, 420).

Groundwater - The mass of gravity water that occupies the subsoil and upper bedrock zone (Marsh 2005, 420).

urbanization

Urbanization is defined as the change in land occupancy and use brought about by the conversion of rural lands to urban, suburban and industrial communities (Lindh 1972, 186). The effects of urbanization include the increase of population density, and the concentration of residential, industrial, and commercial buildings which result in an increase of impervious surface area (Lindh 1972, 186). With the increase of impervious surface, overland flow is introduced and increased from pre-development states. Often times in urban situations water is piped into storm sewers where it is directed as fast and efficiently as possible to the nearest outlet (which is usually a stream or river).

The most important concept of urbanization related to stream systems is that of impervious surfaces. An impervious surface is any hard surface material, such as asphalt or concrete, that limits infiltration and induces high runoff rates (Marsh 2005, 420). As percentage of impervious surface increases, infiltration decreases and runoff increases.

Process of Urbanization:

Transition from Pre-Urban Stage:
- trees and vegetation removed
- development consists of scattered houses and a few constructed wells
- impacts include increased sediment loads due to construction. The water table may be lowered in response to the construction of wells

Transition from Early-Urban to Mid-Urban Stage:
- mass construction of housing and bulldozing of land
- streams are diverted for public water supply
- impervious surfaces increase
- impacts include accelerated land erosion, decreased infiltration due to increased impervious surface area, a drop in stream base flow, and pollution of streams and wells

Transition from Mid-Urban to Late-Urban Stage:
- new public infrastructure including water distribution systems are required
- new sanitary drainage systems and treatment plants are constructed
- large capacity wells, and recharge wells are drilled
- impacts include reduced infiltration and water table, higher flood peaks and lower low flows, increase of polluted waters (Goudie 2006, 133)

impacts of urbanization on stream systems

The conflict between the hydrologic cycle and urbanization commonly leads to four impacts of urbanization on stream systems: physical, chemical, biological, and social.

physical

Hydrology - Changes in flow quantity are seen in streams in urban areas. These changes are seen mostly as higher overall discharges. During rain events lag times are shortened, floods peak more rapidly, and floods have a shorter duration (Meyer, J 2001, 335).

Geomorphology - The most common change in urban streams are the stream structure. Channels are engineered with concrete and stabilization efforts. Along with the in-stream modifications, streams are straightened and the drainage density, the measure of stream length per catchment area, is altered; with the stream length shortening (Meyer, J 2001, 338). Sedimentation and erosion occur when there are changes in the flow regimes. These processes can incise, fill, and widen streams (Meyer, J 2001, 339).

Temperature - Increased water temperature is common in streams in urban environments. This increase can be due to many things. Removal of near stream vegetation can decrease the amount of shade on the water. Decreased groundwater recharge due to urbanization can also impact the temperature change. The heat island is also a factor that increases water temperatures. Water flows off of surfaces that are much hotter than pre-urban conditions (Meyer, J 2001, 341)


figure 1.4: erosion - Brush Creek (Charles McDowell)

figure 1.5: storm sewer overflow sign - Brush Creek (Charles McDowell)

chemical

The chemical impacts on stream systems are highly dependant on the type of urbanization. Different chemicals will be seen in stream drainage areas containing residential, commercial, or industrial development.

Nutrients - The nutrients that are most commonly found in urban streams are phosphorus and nitrogen. Common sources of phosphorus in urban areas are from wastewater, fertilizers, lawns, and streets. Nitrogen sources are wastewater overflows, and fertilizer use. Excess nutrients in a stream system can lead to algal blooms and an increase in biomass.

Metals - Lead, zinc chromium, copper, manganese, nickel, mercury, and cadmium can be found in urban streams. These metals accumulate on roads and parking lots and enter stream systems during rain events (Meyer, J 2001, 344). Metals in streams can lower biodiversity within the system.

Pesticides - Insecticides, herbicides, and fungicides reduce the biodiversity of stream systems. The source of these pesticides can be from homes, commercial or industrial properties, or from lawn and golf course management practices.

biological

Microbes - Bacterial densities are usually substantially higher in urban streams (Meyer, J 2001, 347). Fecal coliform can be found when there is sewer leakage or wastewater overflow in the watershed.

Algae - Herbicides have a negative affect on biodiversity in stream systems. This can decrease algal species diversity. On the other hand, elevated nutrient levels can favor greater algae biomass but reduce the diversity of algal species.

Invertebrates - In urban settings, a decrease in invertebrate density and diversity is a result of increased toxins, temperature change, siltation, and organic nutrients. Increased flow increases turbidity which can reduce in loss of refuge space (Meyer, J 2001, 350).

Fish - Urban streams see an increase in invasive species. Flow modifications, like culverts and other structures, increase barriers for passage and change spawning habitats (Auckland 2-11).

Riparian Vegetation - Historic riparian vegetation is reduced in urban streams as riparian zones become drier. As these zones become drier, wetlands species are absent and upland species become more abundant (Bain, et.al. 2003, 319).

figure 1.6: lack of aquatic habitat - Brush Creek (Charles McDowell)

social

The manipulation of urban streams from a pre-urban state primarily impacts the stream system in three ways; physical, chemical, and biological, which in turn changes the ecological makeup of the whole system (Goudie 2006, 131; Lindh 1972, 185; Meyer, J 2001, 333). Although urbanization alters the stream system itself, it also has a large impact on how people view and interact with the system.

The physical, chemical, and biological changes to the stream usually result in an environment that does not embrace human use or experience. For the most part, urban streams do not allow for any public interaction with the system, and those that do are constructed in a way that people are not exposed to the natural processes and elements of a stream.

Because of the lack of interaction and exposure to healthy urban streams, the general public can have a negative attitude towards streams in urban environments. This problem can be addressed through better management and increased awareness of urban streams in the public realm.

figure 1.7: empty pedestrian walkway - Brush Creek (Charles McDowell)

description . intent

image source (Charles McDowell)

project location

The Brush Creek watershed encompasses approximately 30 square miles of drainage area and is located almost entirely within the heavily urbanized and industrialized Kansas City metropolitan area (Vaughn 1990, 525). The watershed is infamous for floods that have damaged the Country Club Plaza. The Army Corps of Engineers has since added an extensive channelization project in places. The watershed straddles the Kansas/Missouri state line with combined sewers to the east and separate sewers to the west. The watershed is a sub-watershed to the Blue River, a tributary to the Missouri River (US Army Corps of Engineers 2008, 1-2).

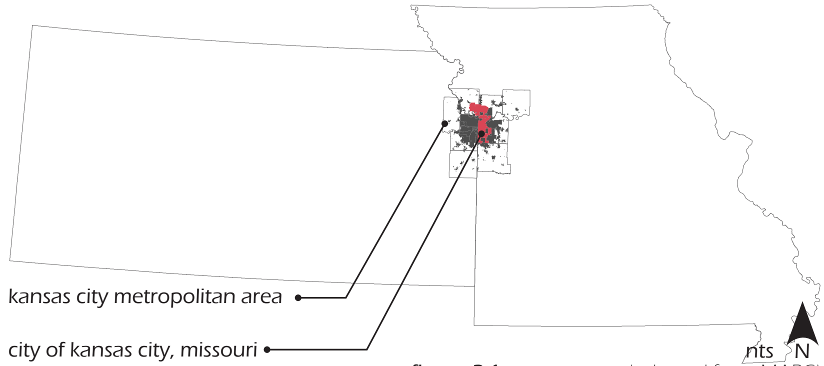


figure 2.1: state context (adapted from MARC)

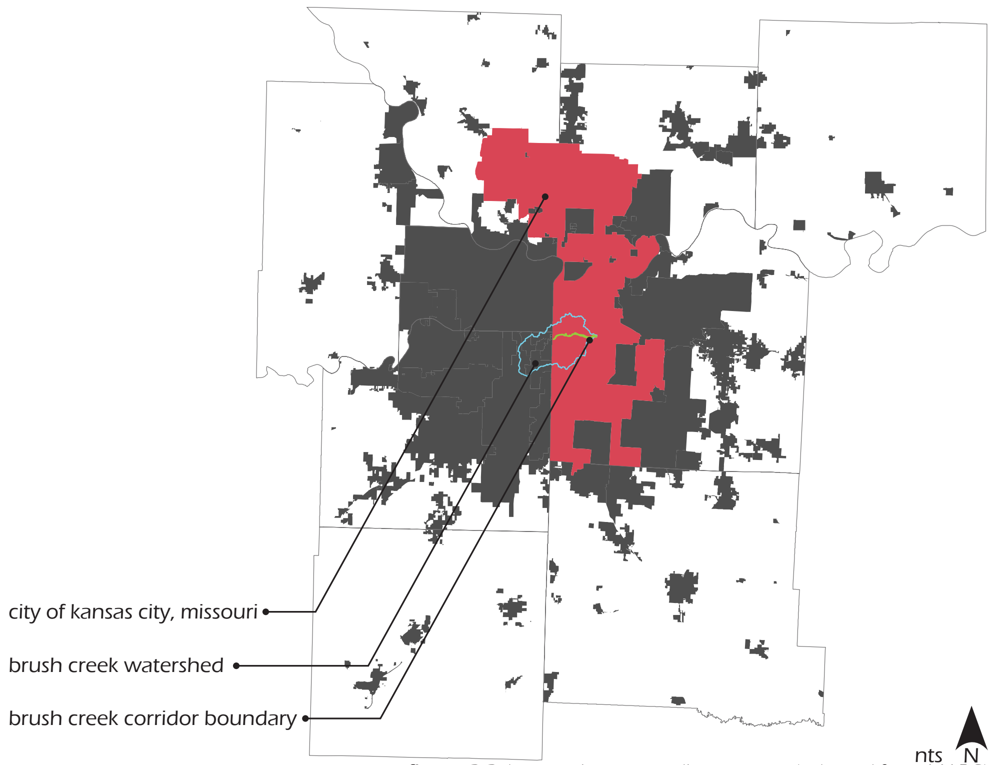


figure 2.2: kansas city metropolitan context (adapted from MARC)

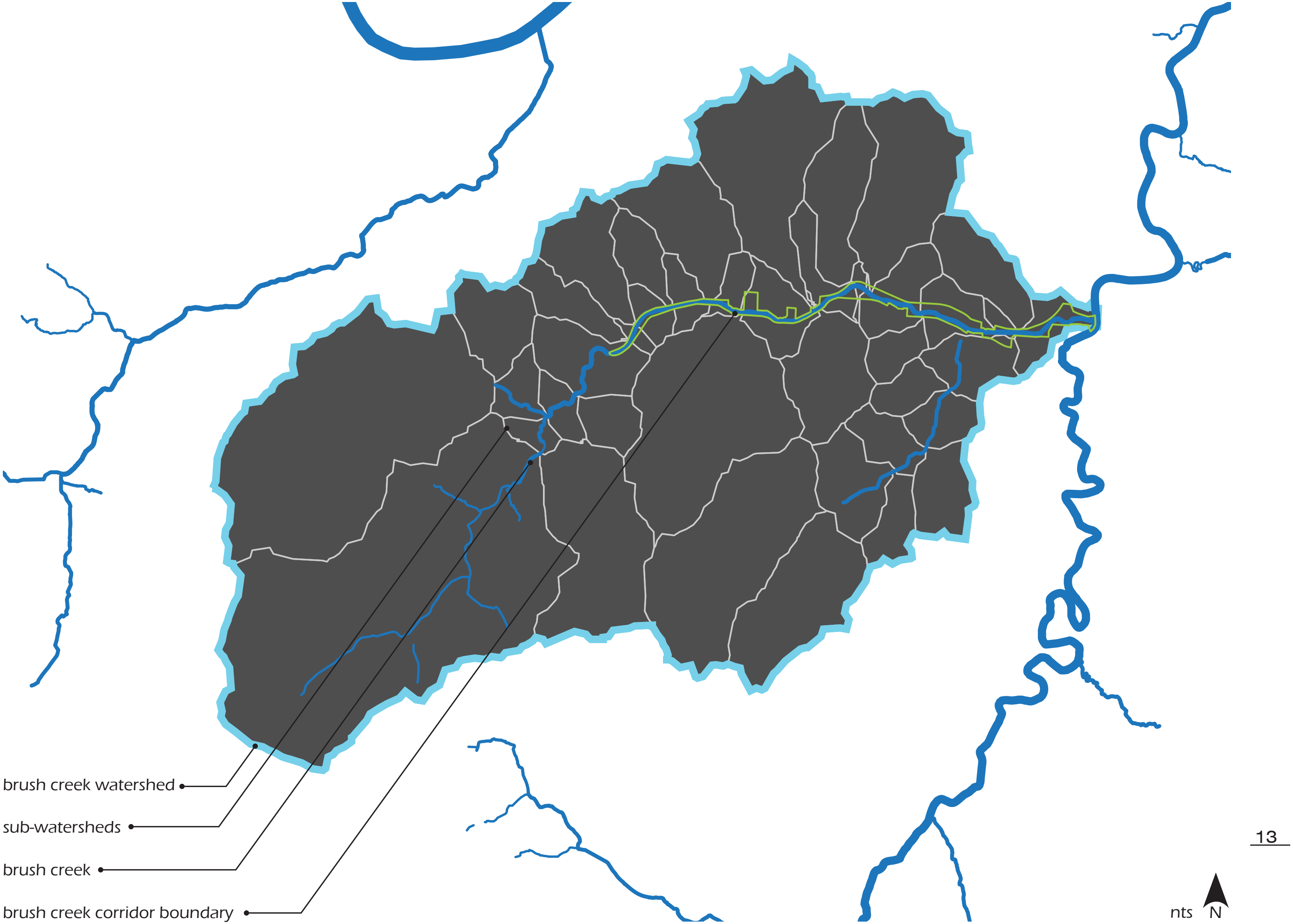


figure 2.3: brush creek watershed (adapted from MARC)

brush creek corridor

location: kansas city, missouri
watershed: lower missouri-crooked, blue river watershed, brush creek watershed
brush creek watershed size: 19,298 acres
study area size: 287 acres
study area length: 5 miles

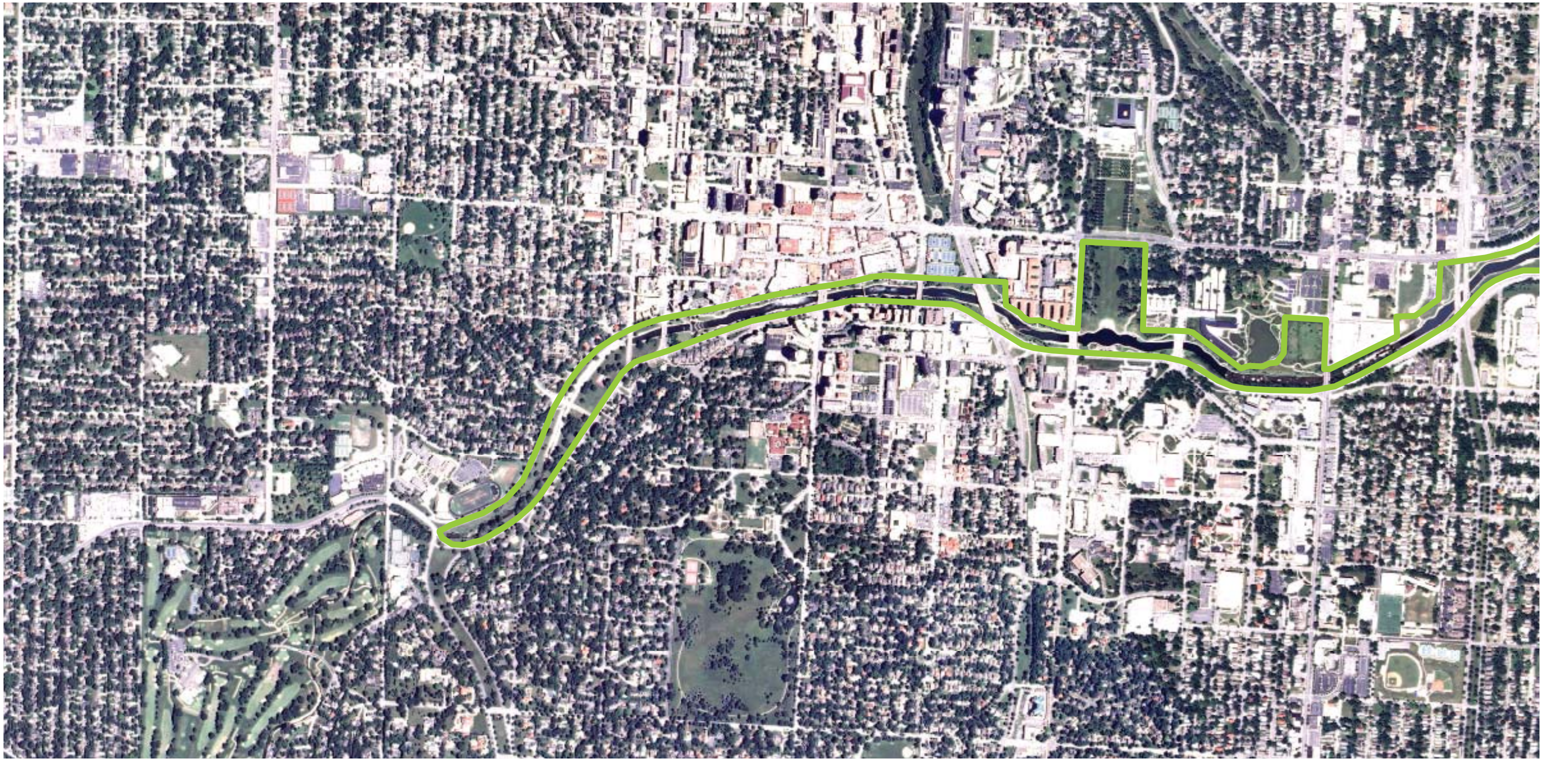
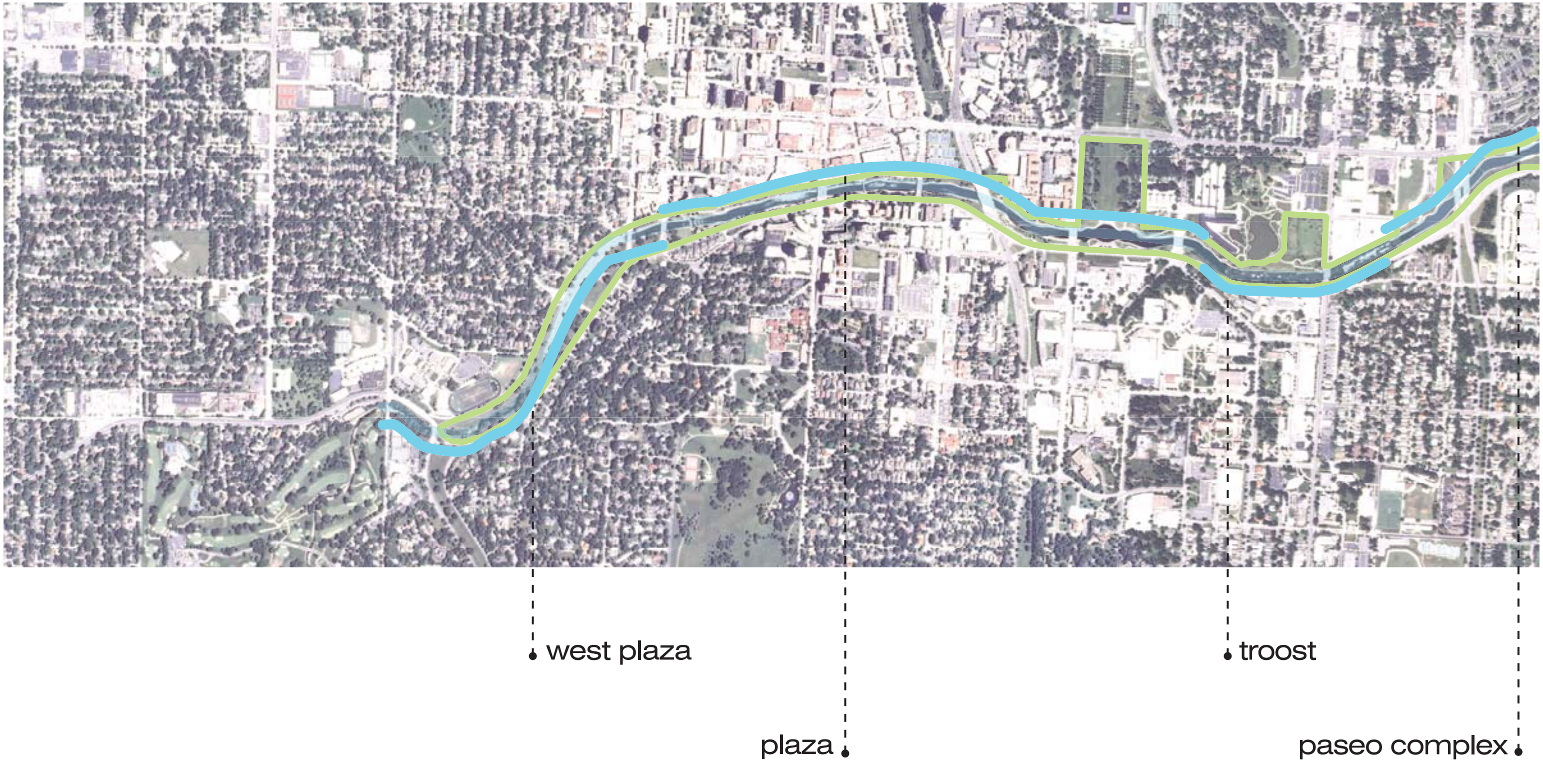


figure 2.4: brush creek corridor (adapted from MARC)

stream reach classification

The City of Kansas City, Missouri has classified nine reaches of Brush Creek spanning between State Line Road and the Blue River:

These classifications are based on many factors including in-stream conditions, near-stream conditions, and adjacent land use. The reaches will be used to examine and discuss the corridor in more detail.



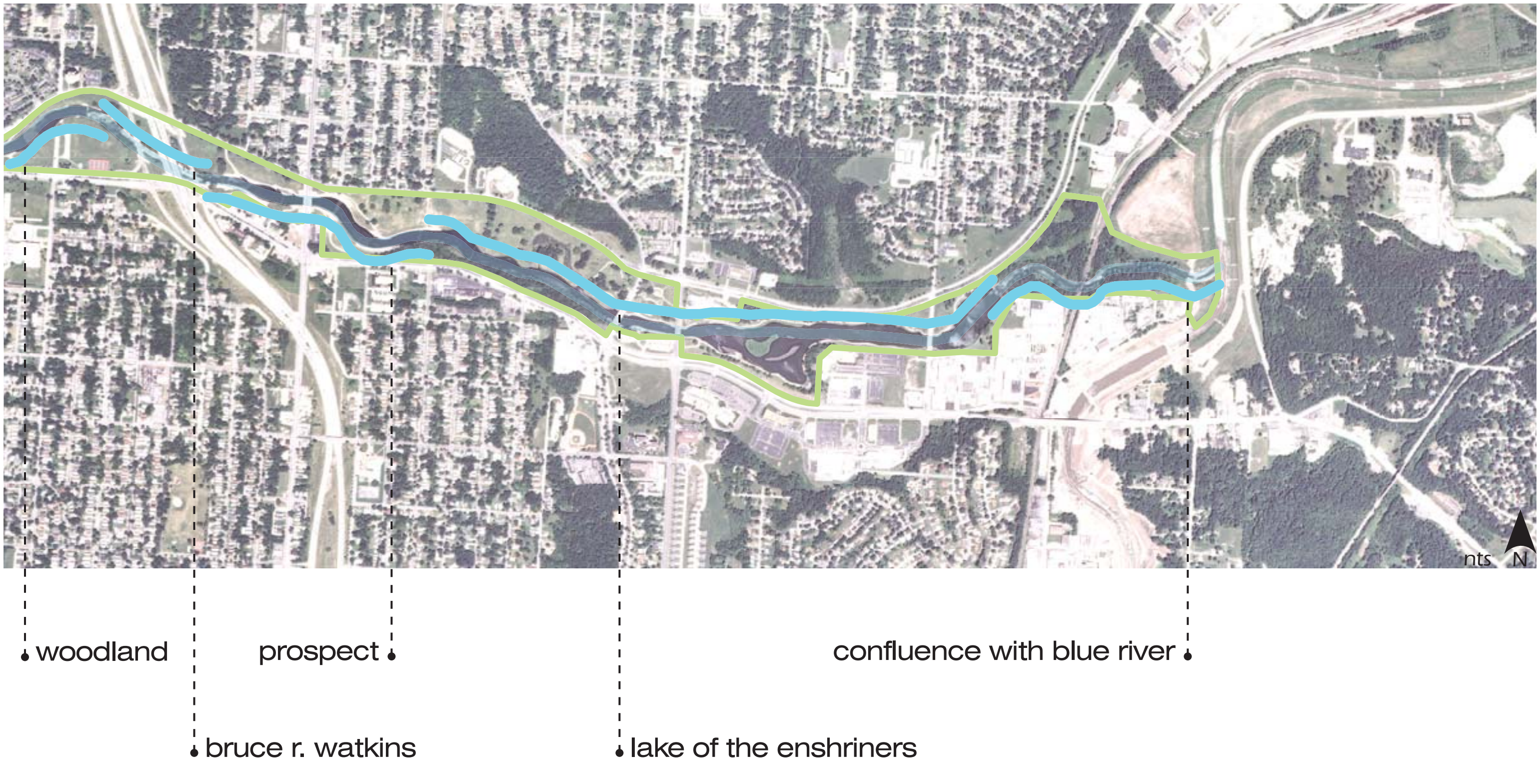


figure 2.5: stream reach classification (adapted from MARC)

west plaza

Location:

The West Plaza reach is the beginning reach in the Brush Creek Corridor being addressed in this study. The reach begins at the Kansas/Missouri border at State Line Road and extends to the Roanoke Parkway Bridge.

In-stream Conditions:

In the upper part of the reach, Brush Creek is in a natural state exhibiting a riffle pool sequence. The stream shows signs of shifting in this area through eroded stream banks. (Figure 2.6) Midway through the reach, the stream is lined with concrete which supports a two to three food wide channel. (Figure 2.8)

Near-stream Conditions:

Brush Creek is confined on either side by Ward Parkway. Park space is located adjacent to the stream in the corridor and ranges in width from 100 feet to 300 feet on either side of Brush Creek. Pembroke Hill School is located near the upper end of the reach and near the end of the reach is the western end of the Country Club Plaza.

figure 2.6: eroding banks - Brush Creek (Charles McDowell)

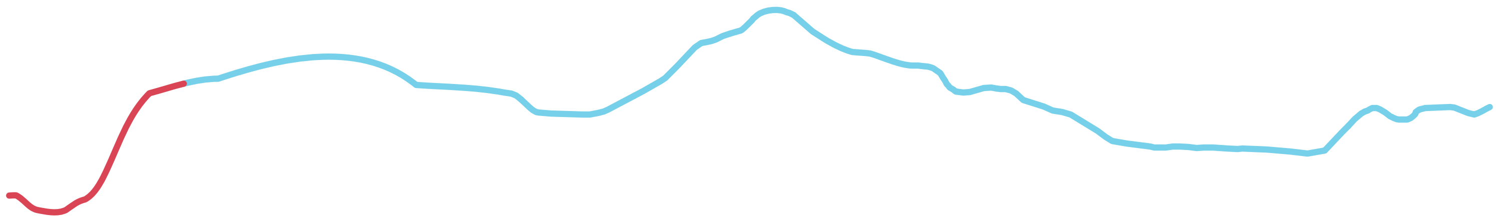


figure 2.7: west plaza identification diagram (Charles McDowell)

figure 2.8: concrete lined channel - Brush Creek (Charles McDowell)

plaza

Location:

The Plaza reach begins at the Roanoke Parkway Bridge and extends to just beyond the Rockhill Road Bridge.

In-stream Conditions:

Throughout this reach, Brush Creek has been modified by the Army Corps of Engineers. This modification consists of the channelization and lining of Brush Creek with concrete in order to help mitigate flood hazards. (Figure 2.9)

Near-stream Conditions:

The first half of the reach is adjacent to the Country Club Plaza and is abutted by walkways and flood walls. The second half of the reach opens up to park space. (Figure 2.11) One major park is Frank Thies Park. The Nelson Atkins Museum of Art and the Kauffman Foundation Headquarters are near this stretch of Brush Creek.

figure 2.9: Army Corps of Engineers flood control project - Brush Creek (Charles McDowell)

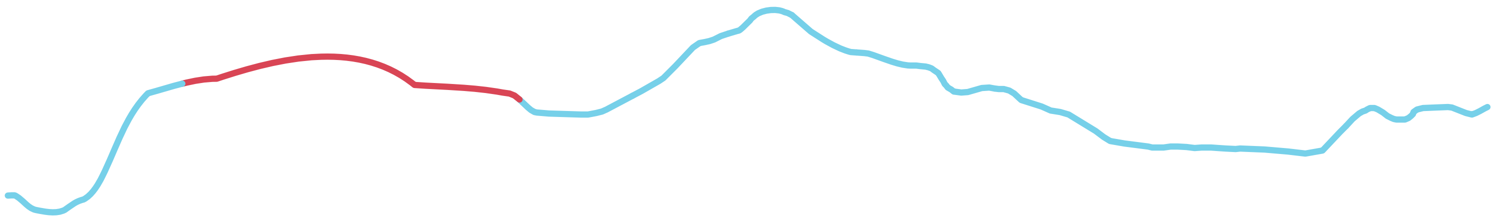


figure 2.10: plaza identification diagram (Charles McDowell)

figure 2.11: green space adjacent to the stream- Brush Creek (Charles McDowell)

troost

Location:

The Troost reach extends from beyond the Rockhill Road Bridge to midway between the Troost Avenue Bridge and the Paseo Bridge.

In-stream Conditions:

The first half of this reach has been modified by the Army Corps of Engineers, channelizing and lining the stream with concrete. (Figure 2.12) The second half has been lined with concrete which supports about a two to three foot wide channel. (Figure 2.14)

Near-stream Conditions:

The Kauffman Foundation Headquarters and Stowers Institute are directly adjacent to this reach of Brush Creek. The Anita B. Gorman Discovery center is located to the north of the reach. The Discovery Center is an environmental educational site which has the ability to relate to Brush Creek.

figure 2.12 Army Corps of Engineers flood control project - Brush Creek (Charles McDowell)

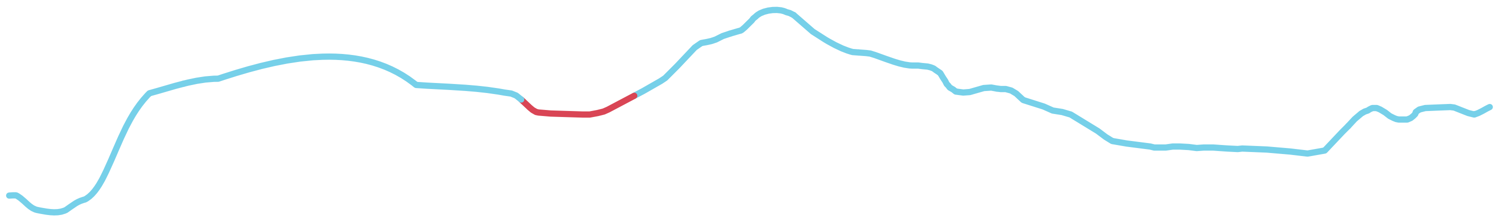


figure 2.13: troost identification diagram (Charles McDowell)

figure 2.14: concrete lined channel - Brush Creek (Charles McDowell)

paseo complex

Location:

The Paseo Complex extends from midway between the Troost Avenue Bridge and the Paseo Bridge to just beyond the Paseo Bridge.

In-stream Conditions:

The entirety of this reach has been modified by the Army Corps of Engineers, channelizing and lining the stream with concrete. (Figure 2.15) Brush Creek is extremely confined by flood walls throughout this reach. (Figure 2.17)

Near-stream Conditions:

The fist half of the reach has some open space to the north but is confined by Swope Parkway to the South. The second half of the reach is confined on both sides by Emanuel Cleaver II Boulevard and Swope Parkway. The Paseo Academy of the Performing Arts and the Kansas City Middle School of the Arts are to the south.

figure 2.15 Army Corps of Engineers flood control project - Brush Creek (Charles McDowell)

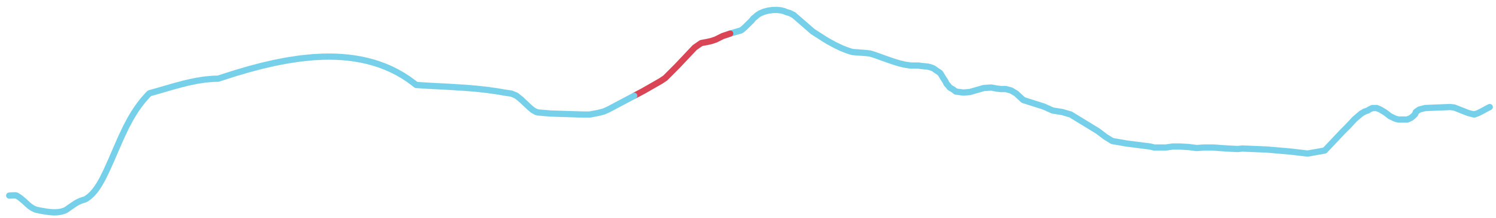


figure 2.16: paseo complex identification diagram (Charles McDowell)

figure 2.17: flood walls - Brush Creek (Charles McDowell)

woodland

Location:

The Woodland reach begins just beyond the Paseo Bridge and extends to the West Bruce R. Waktins Drive access road. Bruce R. Watkins Drive is also known as Highway 71.

In-stream Conditions:

The first half of the reach has been modified by the Army Corps of Engineers, channelizing and lining the stream with concrete. (Figure 2.18) The second half is more natural where the channel parts around an island formed by sedimentation. (Figure 2.20)

Near-stream Conditions:

To the north, Brush Creek is confined by Emanuel Cleaver II Boulevard. To the south, there is a mound of earth that has been deposited from a project upstream where there was excess cut. There is also a parking lot which services a set of four tennis courts.

figure 2.18 Army Corps of Engineers flood control project - Brush Creek (Charles McDowell)

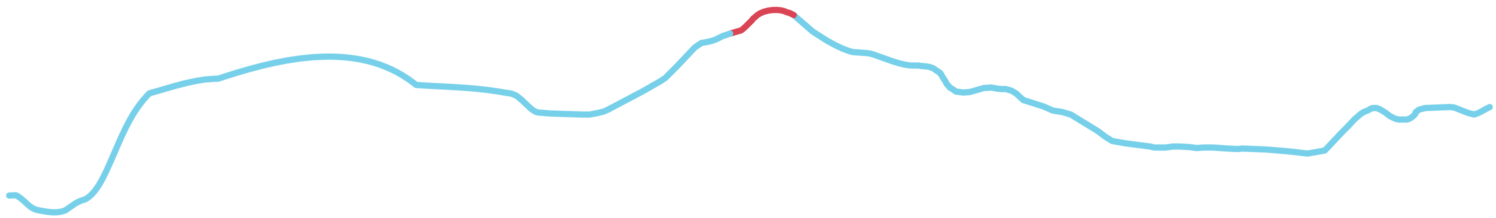


figure 2.19: woodland identification diagram (Charles McDowell)

figure 2.20: in-channel vegetation - Brush Creek (Charles McDowell)

bruce r. watkins

Location:

The Bruce R. Watkins extends from the West Bruce R. Waktins Drive access road to beyond the East Bruce R. Waktins Drive access road. Bruce R. Watkins Drive is also known as Highway 71.

In-stream Conditions:

From the start of the reach to the East Bruce R. Watktins Drive access road, the stream is lined with concrete and supports about a two to three foot wide channel. (Figure 2.21) The last part of the reach has been modified by the Army Corps of Engineers, channelizing and lining the stream with concrete.

Near-stream Conditions:

Brush Creek is confined by the structure of Bruce R. Watkins Drive and the access roads. Near the end of the reach the stream is confined to the south by Swope Parkway. To the north, the floodplain expands into park space. (Figure 2.23)

figure 2.21 concrete lined channel - Brush Creek (Charles McDowell)

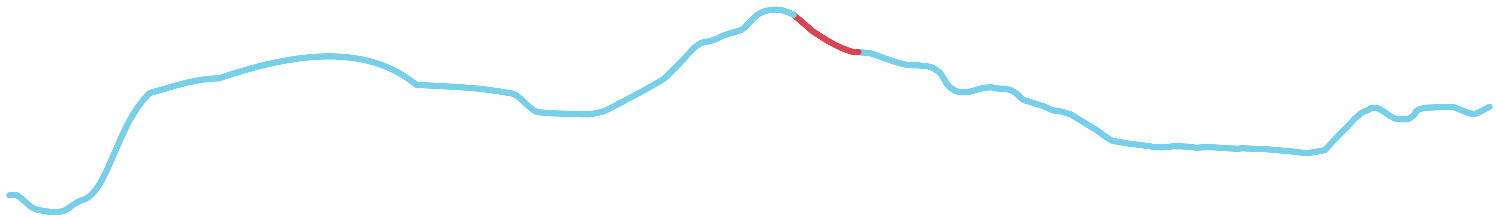


figure 2.22: bruce r. watkins identification diagram (Charles McDowell)

figure 2.23: expanded floodplain - Brush Creek (Charles McDowell)

prospect

Location:

The Prospect reach begins just beyond the East Bruce R. Waktins Drive access road and extends to Agnes Avenue.

In-stream Conditions:

The entirety of the reach has been modified by the Army Corps of Engineers, channelizing and lining the stream with concrete. (Figure 2.26)

Near-stream Conditions:

The Brush Creek Corridor is confined to the south by buildings and Swope Parkway. (Figure 2.24) To the north the stream is not confined and opens up to a considerable amount of park space.

figure 2.24 buildings confining the corridor - Brush Creek (Charles McDowell)

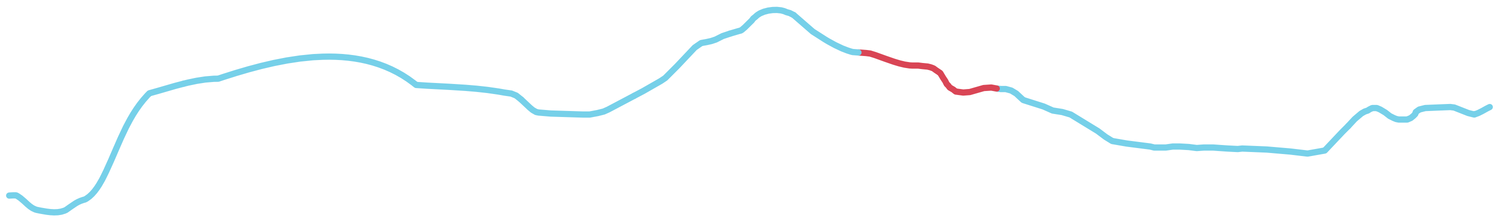


figure 2.25: prospect identification diagram (Charles McDowell)

figure 2.26: Army Corps of Engineers flood control project - Brush Creek (Charles McDowell)

lake of the enshriners

Location:

The Lake of the Enshriners reach extends from Agnes Avenue beyond the Elmwood Avenue Bridge.

In-stream Conditions:

The channel has been widened and there are a series of lakes constructed in this reach. Vegetation lines the edges of the stream and in places there are constructed islands and islands formed by sedimentation. (Figure 2.29)

Near-stream Conditions:

Brush Creek Park lies on either side of Brush Creek in this reach. There is considerable open space on both sides of the stream and there are walkways throughout. (Figure 2.27)

figure 2.27 **Brush Creek Park** - Brush Creek (Charles McDowell)

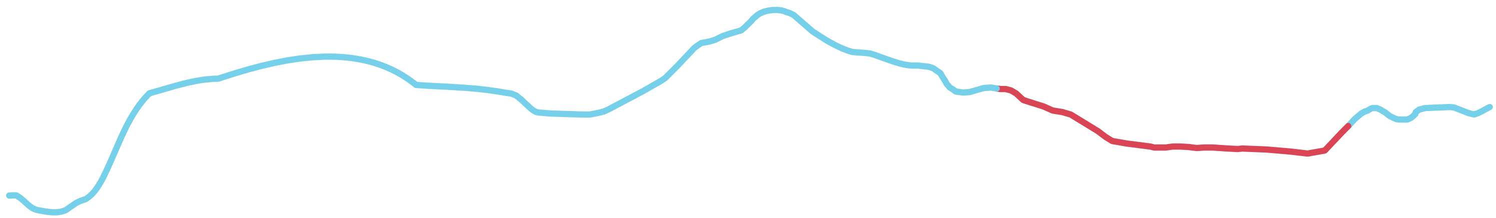


figure 2.28: lake of the enshriners identification diagram (Charles McDowell)

figure 2.29: In-stream islands and vegetation - Brush Creek (Charles McDowell)

confluence with blue river

Location:

The Confluence with Blue River reach extends from just beyond the Elmwood Avenue Bridge to Brush Creek's confluence with the Blue River.

In-stream Conditions:

At the beginning of the reach there is a significant grade change. There is a concrete step waterfall which has protruding concrete barriers at the bottom to prevent large debris from flowing downstream. (Figure 2.30) After the waterfall the stream returns to a more natural state.

Near-stream Conditions:

The reach begins with park space on either side of the stream, but after the waterfall, the corridor is lined with trees in a riparian woodland. (Figure 2.32)

figure 2.30 concrete waterfall and debris barriers - Brush Creek (Charles McDowell)

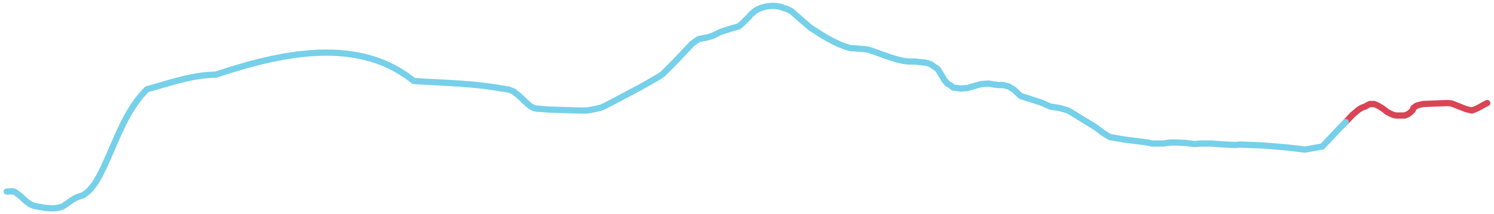


figure 2.31: confluence with blue river identification diagram (Charles McDowell)

figure 2.32: riparian vegetation at confluence - Brush Creek (Charles McDowell)

dilemma

Throughout the history of Kansas City, the stretch of Brush Creek between Shawnee Mission Parkway and the Blue River has experienced severe flooding which, on numerous occasions, has resulted in loss of life. This urban stream supports a high profile area of the city. It is located adjacent to what is considered Kansas City's most elite shopping district, the JC Nichols Country Club Plaza, the University of Missouri - Kansas City urban campus, as well as numerous high density residential units. The stream corridor has been extremely confined due to the encroachment of the surrounding urban environment which has minimized many opportunities for the future management of Brush Creek. There have been many engineering projects dealing with the flooding of Brush Creek but these solutions have only been effective in reducing local flooding instead of addressing the entire corridor. Although previous projects have dealt with flooding nearest high value areas, these solutions have been done in a way that alienates urban dwellers from Brush Creek and do not allow pedestrians to utilize the stream corridor as an effective urban green space.

The Brush Creek Corridor has a number of public parks and open spaces surrounding it including but not limited to: Frank A. Theis Park, Martin Luther King Jr. Square, and Brush Creek Park. The adjacent parks and the stream corridor itself have many pedestrian paths, but there is a lack in connectivity between them. Although these spaces are geared toward pedestrian users they lack in a dynamic experience for the users. The urban environment adjacent to Brush Creek is very diverse in its use and types and numbers of users, but the public spaces fail to relate that diversity, instead offering stagnant spaces which do little to interest or inspire the user. The neglect of the Brush Creek Corridor as an experiential space has resulted in a lost opportunity for environmental education, exploration, and experimentation.

thesis

The Brush Creek Corridor can be redesigned to revitalize the existing area by embracing natural ecological processes in order to create a more sustainable urban stream system. Brush Creek can be envisioned in a way that will enhance visitor experience by exposing and revealing the ecological processes without inhibiting the functionality of those natural processes.

project goals

IMPROVE local environmental conditions through ecological design

manage localized flooding to reduce flash flooding

increase stormwater infiltration

improve water quality within brush creek

CONNECT the corridor for improved pedestrian use

create a design language that can be implemented throughout the corridor

improve access to the corridor

link the existing corridor projects

EDUCATE users to the environmental benefits of ecological design

target selected user groups that could have a potential association with the project

link up with existing environmental improvement goals and initiatives

implement innovative strategies for environmental education

REVEAL and interpret ecological processes and phenomena through design

promote environmental stewardship subconsciously through experience

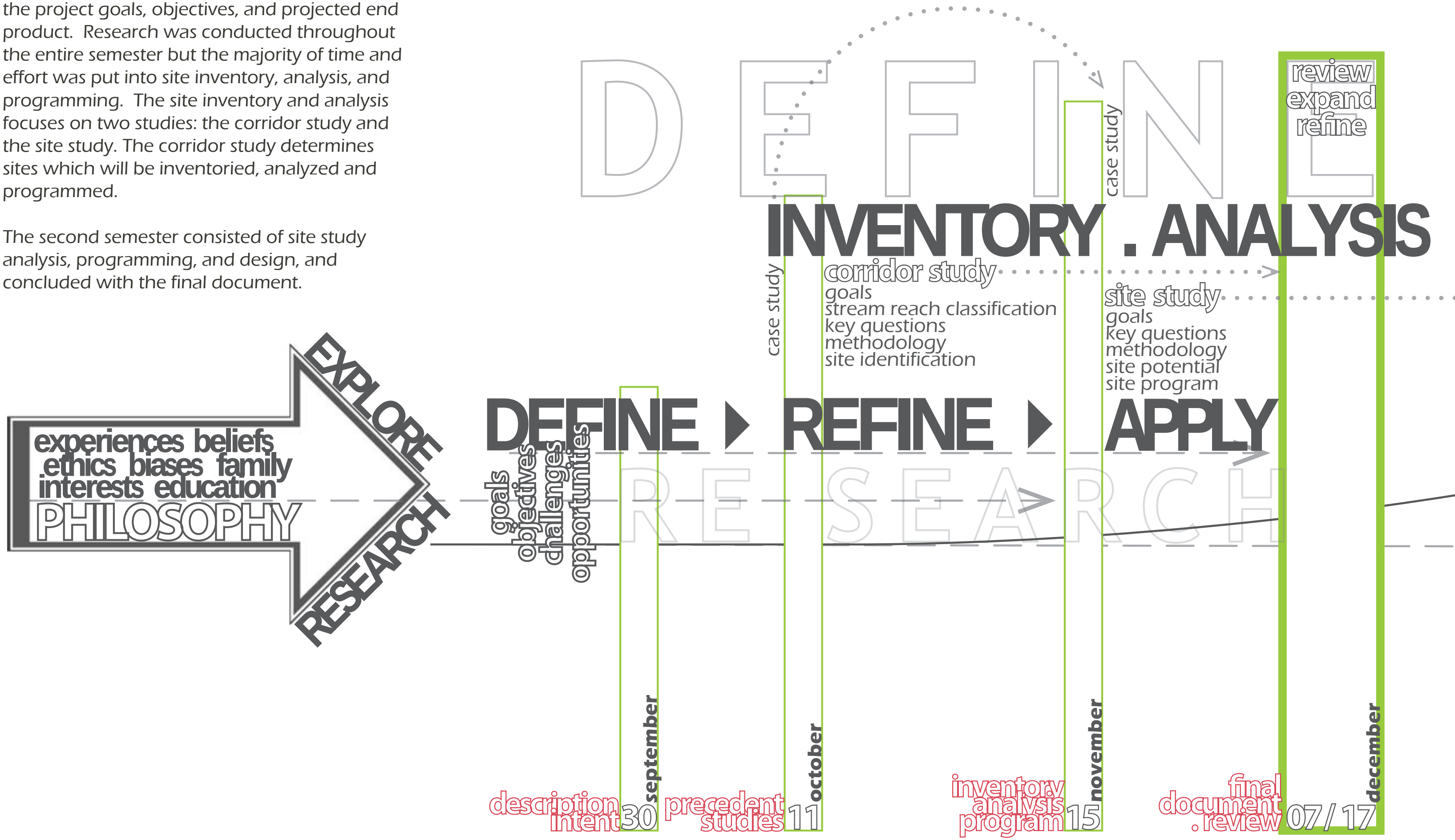
explore new means for conveying environmental education

allow users to create their own relationship with the natural world in a designed setting

design process

The design process diagram illustrates design philosophy, path, tasks, and time. The majority of the first semester was spent defining and refining the project goals, objectives, and projected end product. Research was conducted throughout the entire semester but the majority of time and effort was put into site inventory, analysis, and programming. The site inventory and analysis focuses on two studies: the corridor study and the site study. The corridor study determines sites which will be inventoried, analyzed and programmed.

The second semester consisted of site study analysis, programming, and design, and concluded with the final document.



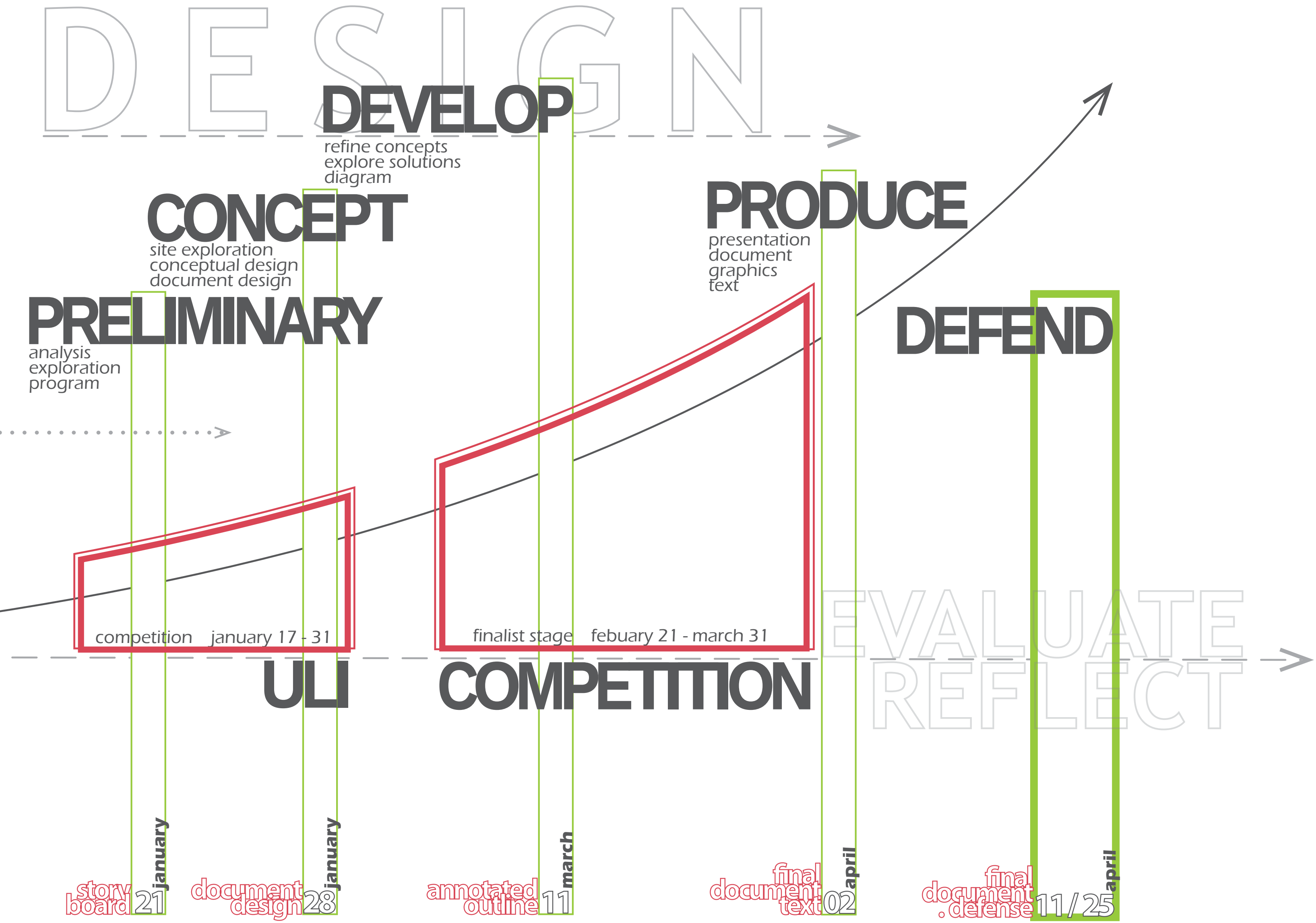


figure 2.33: design process (Charles McDowell)

corridor study

IMPROVE local environmental conditions through ecological design

manage localized flooding to reduce flash flooding

increase stormwater infiltration

improve water quality within brush creek

CONNECT the corridor for improved pedestrian use

create a design language that can be implemented throughout the corridor

improve access to the corridor

link the existing corridor projects

EDUCATE users to the environmental benefits of ecological design

target selected user groups that could have a potential association with the project

link up with existing environmental improvement goals and initiatives

implement innovative strategies for environmental education

REVEAL and interpret ecological processes and phenomena through design

promote environmental stewardship subconsciously through experience

explore new means for conveying environmental education

allow users to create their own relationship with the natural world in a designed setting

corridor study

DETERMINE a specific site, or sites, that are suitable for design and development

PRIORITIZE the selected sites based on a select set of factors to determine an order for site exploration, design, and development

site study

PROGRAM the spaces to optimize surrounding cultural and natural resources

IMPLEMENT site specific ecological and eco-revelatory designs that achieve the project goals and respond to the cultural and natural resources

stream reach classification

the city of kansas city, missouri has classified nine different reaches of brush creek between state line road and the blue river

these classifications were based on many factors include in-stream conditions, near-stream conditions, and much more

for the corridor study, the classifications formed by kcmo will be used

the reaches are:

west plaza
plaza reach
troost reach
the paseo complex
woodland reach
bruce r. watkins
prospect reach
lake of the enshriners
confluence with blue river

key questions

factors to be considered

IMPROVE

what reaches of the Brush Creek Corridor have the highest vulnerability to environmental degradation?

VULNERABILITY

physical
stream reach

where are the completed channel design projects?	current project status
in what reaches are the channel design projects in a dilapidated state?	in-stream conditions
what stream reaches show negative impacts from the flows of brush creek?	in-stream conditions
what is the degree of development adjacent to the stream?	degree of stream confinement
what areas would be influenced by a 100 or 500 year flood?	flood-prone areas
what areas or buildings in the adjacent drainages are consistently flooded?	flood-prone areas

CONNECT

what areas along the Brush Creek Corridor have the highest potential for connecting the corridor?

SUITABILITY

physical
adjacent area

at what points does the corridor lack connections between projects?	pedestrian circulation
where are the pedestrian access points to the stream corridor?	pedestrian circulation
what parks or pedestrian oriented spaces are adjacent to the stream?	near-stream conditions
what major barriers parallel the stream?	near-stream conditions
what are the parallel roads that act as barriers to the stream corridor?	adjacent and crossing roads
what crossing roads act as barriers to the stream corridor?	adjacent and crossing roads
where are the highest densities of people living around the corridor?	population

EDUCATE

what areas along the Brush Creek Corridor have the highest potential to take advantage of environmental educational opportunities?

SUITABILITY

social
adjacent area

what relationships do organizations such as the kc art institute or the anita b. gorman discovery center have with the corridor?	special interest areas
what areas can directly or indirectly relate to the country club plaza?	special interest areas
do the goals and objectives of the green impact zone align with this project?	green impact zone
what schools have the closest physical connection to the stream corridor?	schools
what type of school (elementary, middle, high, university; public vs. private) would best create an educational connection with the project?	schools
where are the highest densities of select demographics, such as ages 5 to 17, located in relationship to the corridor?	population

site study

figure 2.34: corridor study process (Charles McDowell)

site study

PROGRAM the spaces to optimize surrounding cultural and natural resources

IMPLEMENT site specific ecological and eco-revelatory designs that achieve the project goals and respond to the cultural and natural resources

key questions

how did brush creek flow in the past?

where did brush creek flow in the past and what was it's influence on the site?

is there potential for extended water infiltration or wetlands on the site?

where was the historical floodplain located and in what state is the floodplain currently in?

what are the historical and current vegetation patterns?

what are the potential riparian habitats?

what species are currently using the corridor for habitat and what species can be targeted for habitat restoration?

what are the geologic materials and how can that impact potential vegetation?

how deep is the bedrock beyond the surface?

what are the suitable areas to mitigate flood impacts on site?

do people need to cross brush creek on the site?

what are the barriers inhibiting pedestrians from using the site?

what areas around the site are potential destinations or origins of pedestrian traffic?

factors to be considered

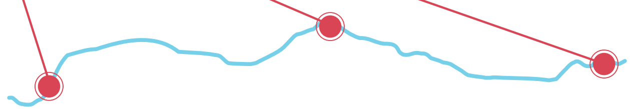
historic stream form
historic stream alignment
depressions
steep slopes
existing vegetation
historic vegetation patterns
wildlife/habitat potentials
surface geology
bedrock geology
soils- moisture holding capacity
flood-prone areas
pedestrian/vehicular circulation
physical/social barriers
surrounding destinations

program potential

west plaza

woodland . bruce r. watkins

confluence with blue river



IMPROVE
- in-channel modifications
- flood control
- stream bank stabilization
- stormwater management
- vegetation and habitat

CONNECT
- circulation and connection
- stream crossings
- destinations and activities
- recreation
- security

EDUCATE
- demonstration projects
- interpretation
- outdoor education

REVEAL

site identification

figure 2.35: site study process (Charles McDowell)

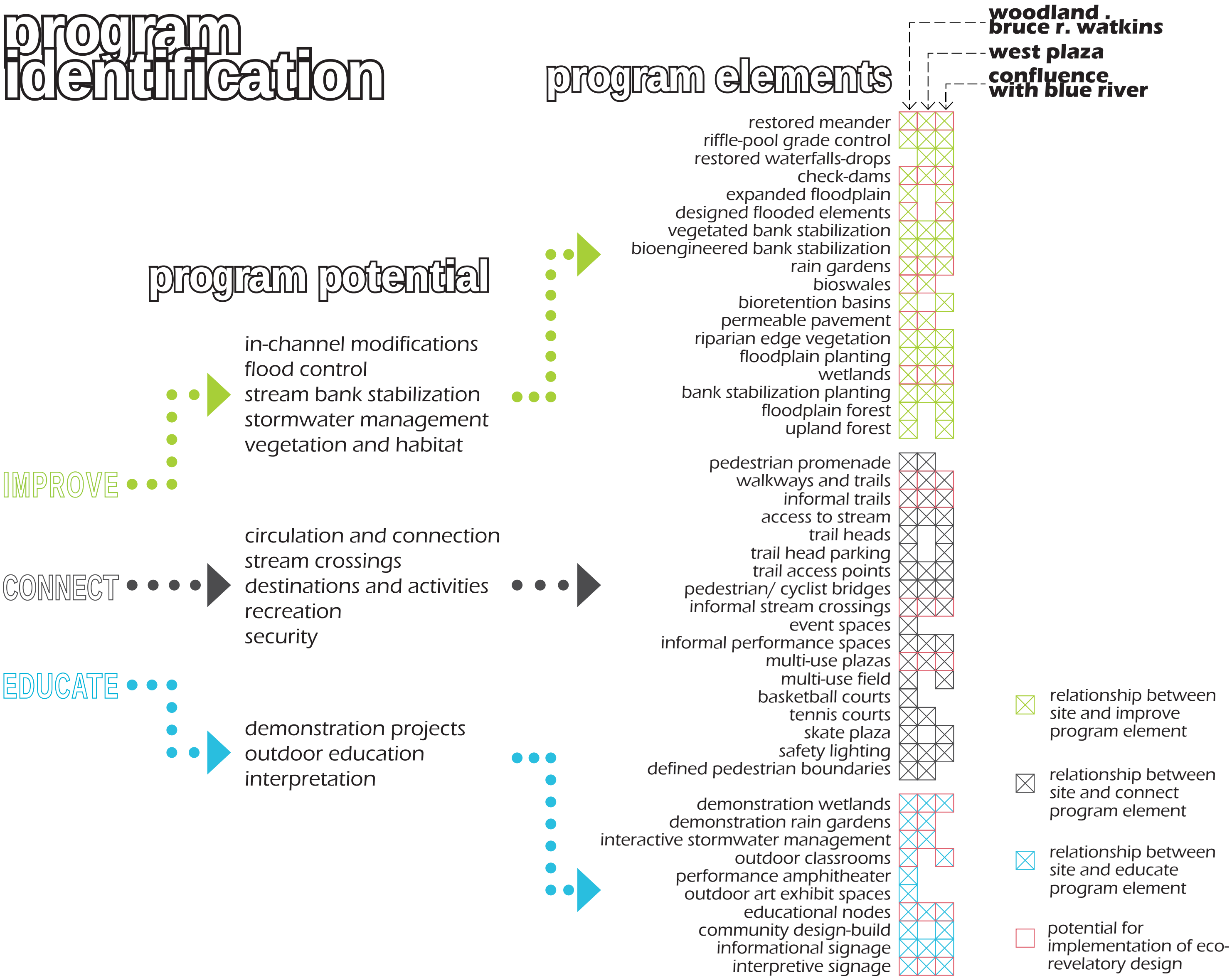


figure 2.36: program identification process (Charles McDowell)

precedent study

image source (Charles McDowell)

four mile run
alexandria, virginia

Designers and Consultants
Rhodeside & Harwell, Incorporated
CH2M Hill
Biohabitats, Incorporated
Waterscapes / Dreiseitl

Client:
Arlington County & City of Alexandria

Plan adopted March 2006

Project Background

The lower Four Mile Run corridor—2.3 miles along the border of Alexandria and Arlington, from Shirlington to the confluence with the Potomac River—constitutes an untapped and largely forgotten resource. In spite of lingering natural beauty and the inherent attraction of water, the stream corridor functions primarily as a flood control channel—an in-between space defined by its concrete banks, the utility infrastructure lining its shore and the buildings that turn their backs to the stream. Rather than a gathering place, where surrounding neighborhoods of Alexandria and Arlington can celebrate their diversity and vitality, the stream has continued to defy its potential as a source of community pride. (Rhodeside & Harwell Incorporated 2006, 2)

Historical Context

In response to a history of flooding affecting adjacent communities, the U.S. Army Corps of Engineers partnered with Alexandria and Arlington to build a flood control channel in the lower portion of Four Mile Run. The flood control channel, constructed during the 1970s and early 1980s, has safely conveyed the high storm flows through the two jurisdictions. Although successful in flood control, however, the channelized portion of Four Mile Run leaves much to be desired in terms of aesthetic and environmental attributes. The nearly uniform trapezoidal shape of the channel does not offer many of the natural characteristics of streams—such as riffles, pools and shady areas—that are needed to sustain much of the aquatic life once found in Four Mile Run. (Rhodeside & Harwell Incorporated 2006, 4)

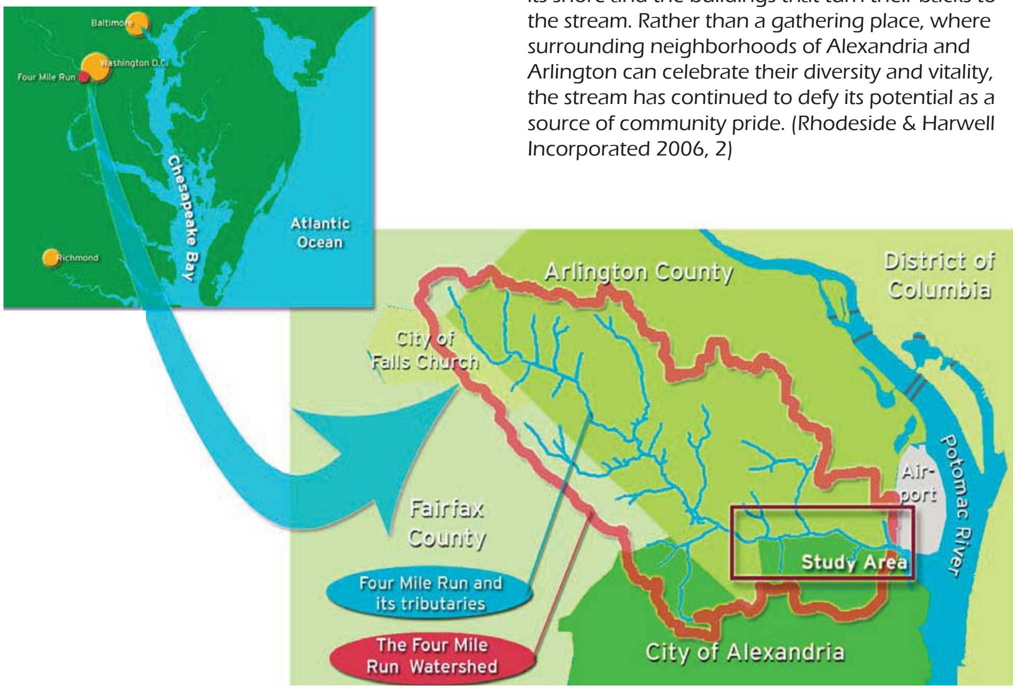


figure 3.1: watershed and location map (Rhodeside & Harwell Incorporated 2006)

Guiding Principles

The purpose of the Master Plan is to provide a framework and vision for the Four Mile Run corridor. The Master Plan envisions that the Four Mile Run corridor will be a model of urban ecological restoration. Through the sensitive and sustainable integration of natural areas with active nodes, the Four Mile Run corridor will be a place along which the communities of Arlington County and the City of Alexandria can gather, recreate and celebrate a shared waterfront legacy. (Rhodeside & Harwell Incorporated 2006, 9-10)

The guiding principles for the project encompass eight key focus areas: flood protection, environment, aesthetics and design, recreation and urban life, integration and balance, access and connectivity, education and interaction, and the planning horizon.

Program Elements

The Master Plan expands on two design themes to further focus design language and program elements, green principles and public spaces.

Green Principles:
- channel restoration and stabilization
- habitat restoration
- stormwater management
- green buildings
- community awareness

Public Spaces:
- trails and pedestrian bridges
- promenades and plazas
- green open space
- sports facilities
- public art

Relevance to Project

The Four Mile Run corridor and the Brush Creek Corridor have a similar project history in that they were both constructed by the Army Corps of Engineers to mitigate flood hazards. Both corridors are designed for function and do not consider aesthetics and user experience.

The project goals for the Brush Creek Corridor directly relate to the project principles and design of Four Mile Run. Although the Four Mile Run Master Plan addresses many in-stream, near-stream and surrounding community issues, the Master Plan directly addresses the need to improve, connect, and educate throughout the corridor. The diagrams concerning these issues are as follows: hydrology and flood control, vegetation and habitat, circulation and connection, and education and interpretation.

figure 3.2: context and channel form (adapted from Rhodeside & Harwell Incorporated 2006, 7-8)

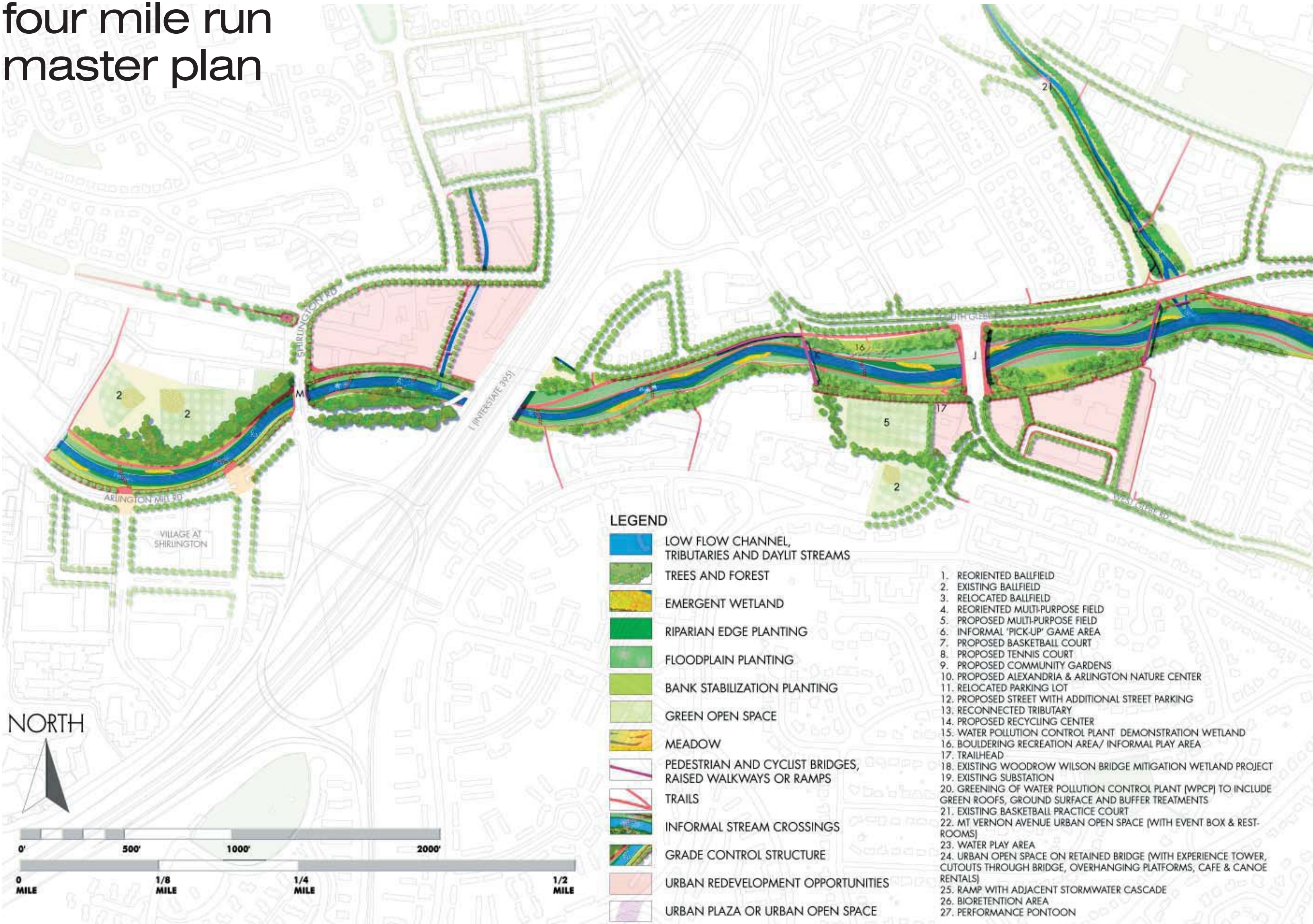
context and channel form

legend

existing channel

proposed channel

four mile run master plan



LEGEND

- LOW FLOW CHANNEL, TRIBUTARIES AND DAYLIT STREAMS
- TREES AND FOREST
- EMERGENT WETLAND
- RIPARIAN EDGE PLANTING
- FLOODPLAIN PLANTING
- BANK STABILIZATION PLANTING
- GREEN OPEN SPACE
- MEADOW
- PEDESTRIAN AND CYCLIST BRIDGES, RAISED WALKWAYS OR RAMPS
- TRAILS
- INFORMAL STREAM CROSSINGS
- GRADE CONTROL STRUCTURE
- URBAN REDEVELOPMENT OPPORTUNITIES
- URBAN PLAZA OR URBAN OPEN SPACE

1. REORIENTED BALLFIELD
2. EXISTING BALLFIELD
3. RELOCATED BALLFIELD
4. REORIENTED MULTI-PURPOSE FIELD
5. PROPOSED MULTI-PURPOSE FIELD
6. INFORMAL 'PICK-UP' GAME AREA
7. PROPOSED BASKETBALL COURT
8. PROPOSED TENNIS COURT
9. PROPOSED COMMUNITY GARDENS
10. PROPOSED ALEXANDRIA & ARLINGTON NATURE CENTER
11. RELOCATED PARKING LOT
12. PROPOSED STREET WITH ADDITIONAL STREET PARKING
13. RECONNECTED TRIBUTARY
14. PROPOSED RECYCLING CENTER
15. WATER POLLUTION CONTROL PLANT DEMONSTRATION WETLAND
16. BOULDERING RECREATION AREA/ INFORMAL PLAY AREA
17. TRAILHEAD
18. EXISTING WOODROW WILSON BRIDGE MITIGATION WETLAND PROJECT
19. EXISTING SUBSTATION
20. GREENING OF WATER POLLUTION CONTROL PLANT (WPCP) TO INCLUDE GREEN ROOFS, GROUND SURFACE AND BUFFER TREATMENTS
21. EXISTING BASKETBALL PRACTICE COURT
22. MT VERNON AVENUE URBAN OPEN SPACE (WITH EVENT BOX & RESTROOMS)
23. WATER PLAY AREA
24. URBAN OPEN SPACE ON RETAINED BRIDGE (WITH EXPERIENCE TOWER, CUTOUTS THROUGH BRIDGE, OVERHANGING PLATFORMS, CAFE & CANOE RENTALS)
25. RAMP WITH ADJACENT STORMWATER CASCADE
26. BIORETENTION AREA
27. PERFORMANCE PONTOON

figure 3.3: *master plan (Rhodeside & Harwell Incorporated 2006, 41-42)*

hydrology and flood control

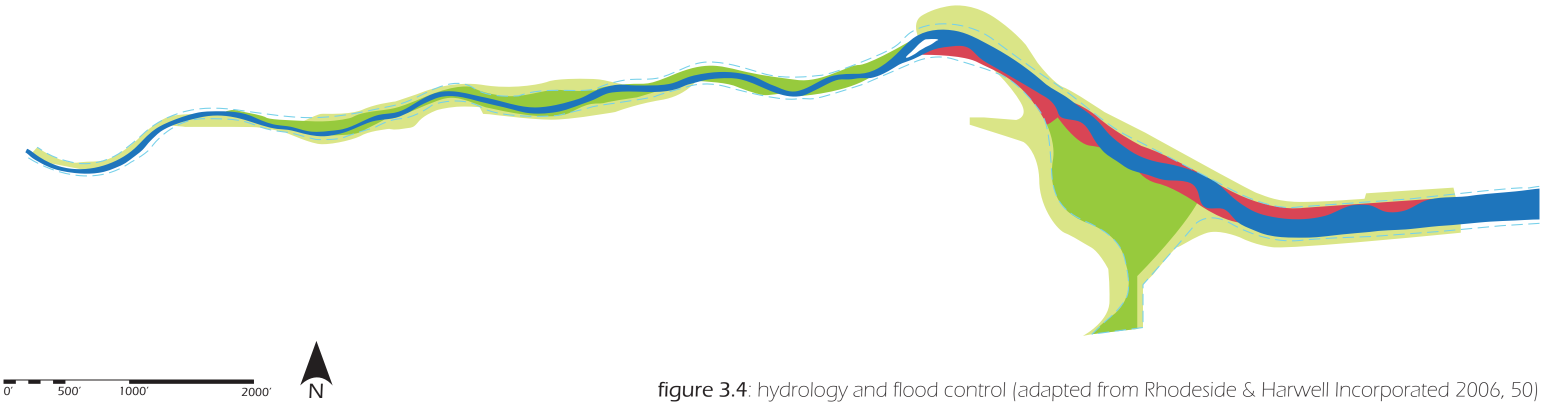
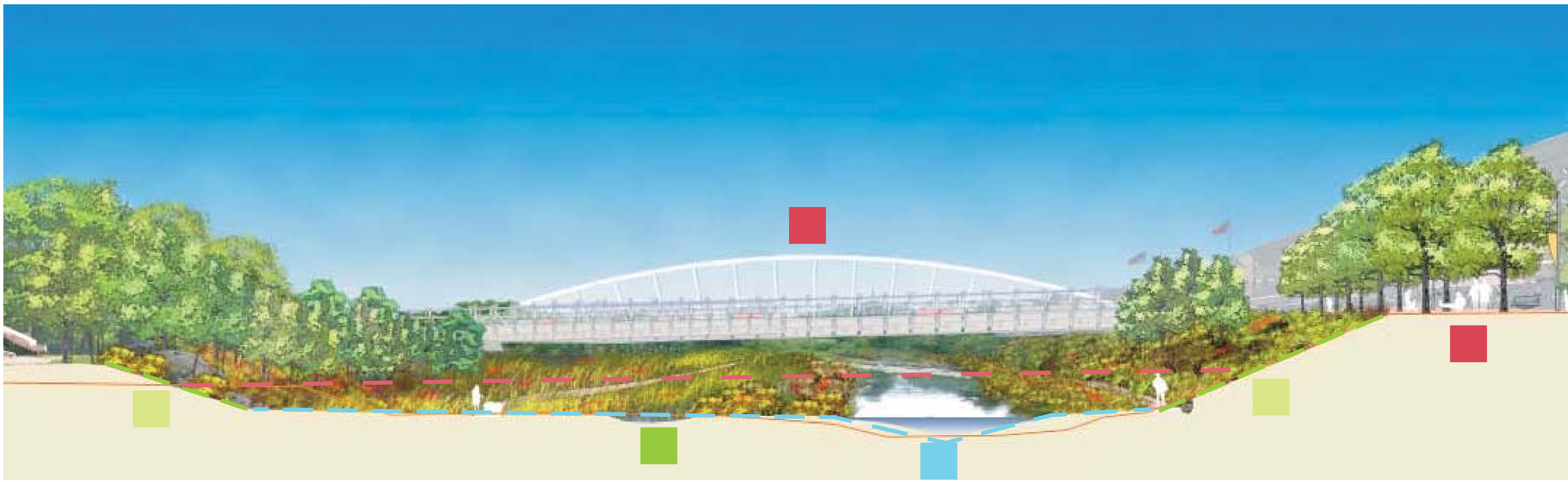


figure 3.4: hydrology and flood control (adapted from Rhodeside & Harwell Incorporated 2006, 50)



legend

- vegetated inset floodplain
- vegetated bank stabilization
- wetland bar
- four mile run
- extent of inset floodplain

Create a "dynamically stable stream channel" using natural stream channel design techniques.

A dynamically stable channel is defined as a channel that has an appropriate channel cross-section to transport sediment during normal flow conditions;
however, it is designed to adjust laterally within this basic form in response to large flows in order to minimize hard stabilization and maintenance.

The in-stream design shown on the hydrology and flood control plan was developed to specifically address the following guiding principles:

• Provide a minimum 100-year event flood protection.
• Consider flood protection for areas not currently protected.
• Create a "dynamically stable stream channel" using natural stream channel design techniques.

(Rhodeside & Harwell Incorporated 2006, 45-48)

Design elements:

Low flow channel - the area within the Four Mile Run corridor that will convey water during both low-flow and high flow conditions

Vegetated inset floodplain - the area inundated frequently during flows greater than the determined channel-forming flow for the low-flow channel

Bioengineered toe protection - protects the bottom of the slope that connects the low-flow channel to the inset floodplain

Bank stabilization - stream banks will be stabilized using either bioengineering or vegetative means based on the risk of erosion

Step-pool grade control - a structure that mimics the rock jam – plunge pool sequences to maintain bed elevations in impaired systems

(Rhodeside & Harwell Incorporated 2006, 49-52)

figure 3.5: hydrology and flood control section (Rhodeside & Harwell Incorporated 2006, 45-46)

legend

- low-flow channel
- vegetated inset floodplain
- vegetated bank stabilization
- public / pedestrian open space
- high flow event
- dynamically stable - adjusts laterally
- will not adjust

vegetation and habitat

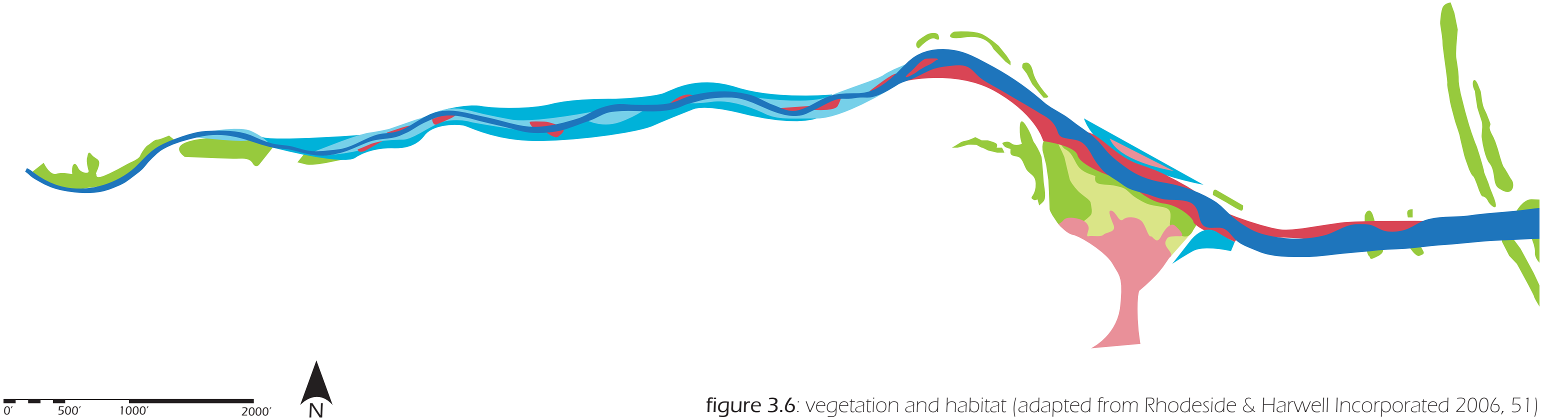
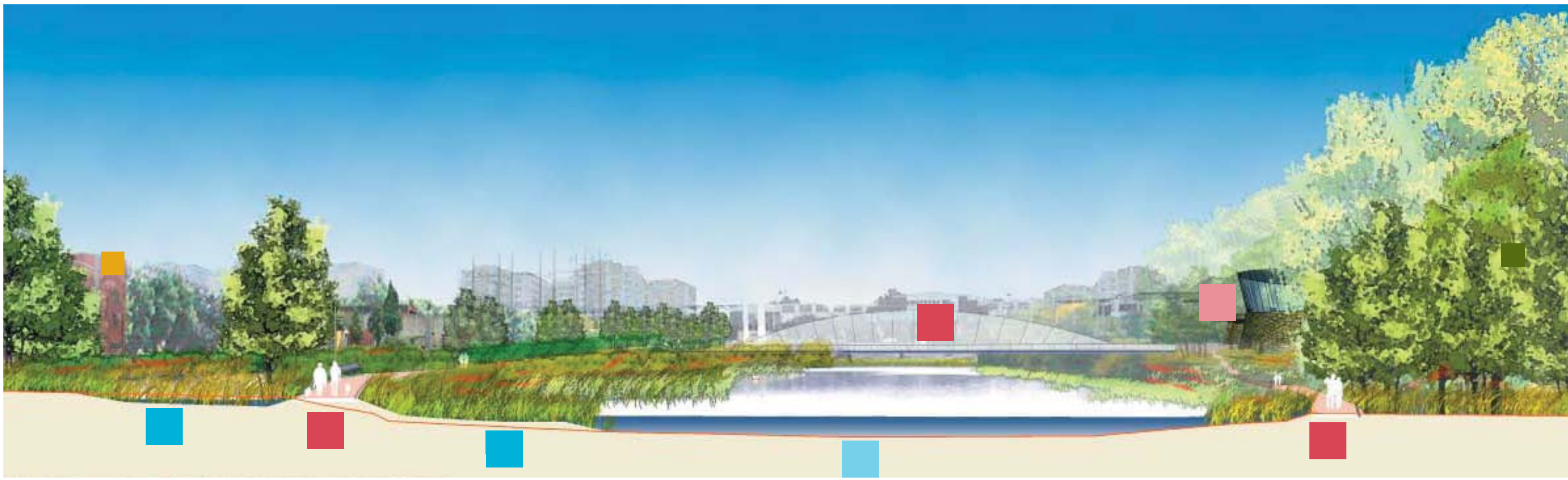


figure 3.6: vegetation and habitat (adapted from Rhodeside & Harwell Incorporated 2006, 51)



legend

- upland forest
- floodplain forest
- bank stabilization planting
- floodplain planting
- wetland bars and cells
- emergent wetland
- four mile run

Improve the stream corridor ecosystem.

Ecosystem restoration—including the preservation and enhancement of existing vegetation and the introduction, where feasible, of new vegetative communities—benefits the stream corridor by providing additional flood and erosion control, stabilizing stream banks, filtering and removing pollutants from water entering the channel, regulating temperatures, and providing habitat for aquatic, terrestrial, and avian organisms.

The restoration proposals in the vegetation and habitat plan respond to the following guiding principles:

- Improve corridor habitat and ecology to support native terrestrial and aquatic plant and animal species.
- Reestablish the vegetation that once lined the stream and existed in the lowland wetlands areas but has since disappeared or been colonized by invasive species.

(Rhodeside & Harwell Incorporated 2006, 53)

Design elements:

Upland forest - mixed upland hardwood community includes moderately mature trees and shrubs

Floodplain forest - vegetative communities neighboring a stream channel, subject to periodic inundation

Riparian edge - planting along the banks of the inset, low-fl ow channel will provide bank stability and in-stream cover.

Floodplain planting - native shrubs and grasses planted on the inset floodplain

Wetland cells - emergent freshwater wetland vegetation planted in permanently flooded pockets (cells) within the inset floodplain

Bank stabilization planting - woody trees, shrubs, and herbaceous plants planted on the banks of the flood control channel

(Rhodeside & Harwell Incorporated 2006, 55-58)

figure 3.7: vegetation and habitat section (Rhodeside & Harwell Incorporated 2006, 53-54)

legend

- low-flow channel
- wetlands
- upland forest
- floodplain forest
- pedestrian walkways
- nature center
- existing profile

circulation and connection

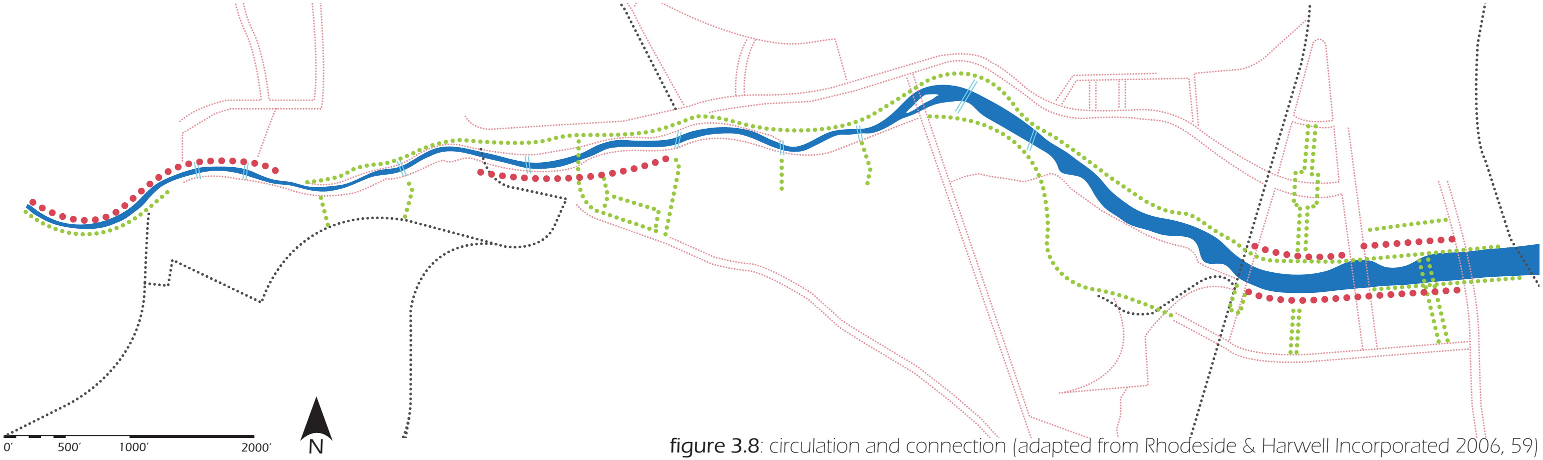


figure 3.8: circulation and connection (adapted from Rhodeside & Harwell Incorporated 2006, 59)

legend

- sitting nook
- informal trail
- connection under bridge
- pedestrian/ cyclist bridge
- small pedestrian bridge

figure 3.9: circulation and connection perspective 1 (adapted from Rhodeside & Harwell Incorporated 2006, 46)

legend

- pedestrian and cyclist promenade
- pedestrian and cyclist 10-12 ft wide
- pedestrian and cyclist 6-8 ft wide
- existing pedestrian and cyclist
- pedestrian and cyclist bridge
- four mile run

Create a place for people to reconnect with water and nature within an urban context.

A major objective of the master plan is to provide a greater range of enjoyable, safe, easy-to-use and beautiful connections to and across the stream corridor.

The circulation and connection plan responds to the following guiding principles:

• Create a place for people to reconnect with water and nature within an urban context
• Increase pedestrian and bicycle access and amenities
• Ensure that Four Mile Run is accessible to all who wish to use it
• Increase connectivity between the two communities
• Enhance the corridor's effectiveness as a non-motorized and mass transit corridor.

(Rhodeside & Harwell Incorporated 2006, 58)

Design elements:

Continuous and linked trail system - scenic, attractive and continuous trail systems line both sides of the stream corridor and accommodate pedestrians, joggers and bicyclists

Physical linkages between communities - linkages between the communities of Arlington and Alexandria are created by a series of new pedestrian bridges along the corridor

Safe and secure access - lighting plays a key role in fostering a sense of security along all streets and trails in the corridor

New intersections - new intersections offer an added benefit to the community by opening up new green spaces along the stream for public use

(Rhodeside & Harwell Incorporated 2006, 58-61)

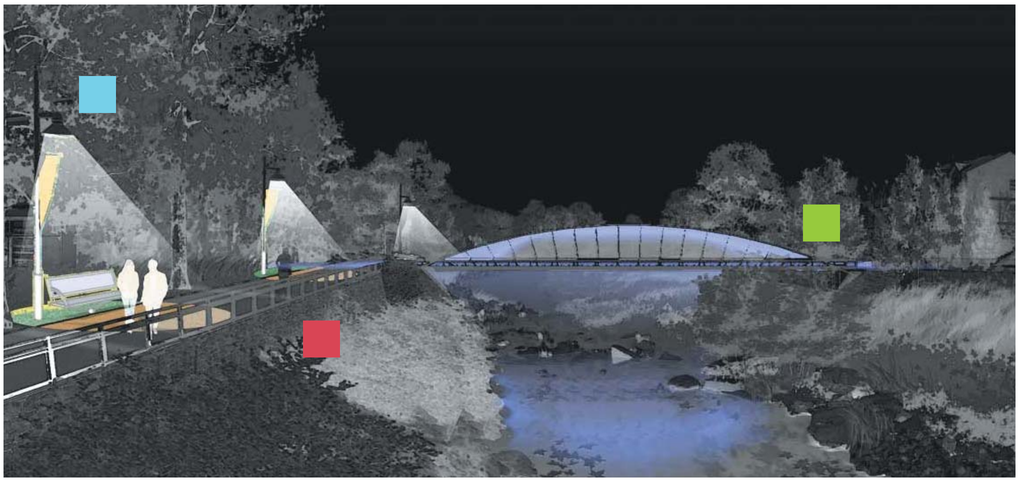


figure 3.10: circulation and connection perspective 2 (adapted from Rhodeside & Harwell Incorporated 2006, 46)

legend

- safety lighting
- lit pedestrian bridge
- defined pedestrian edge

education and interpretation

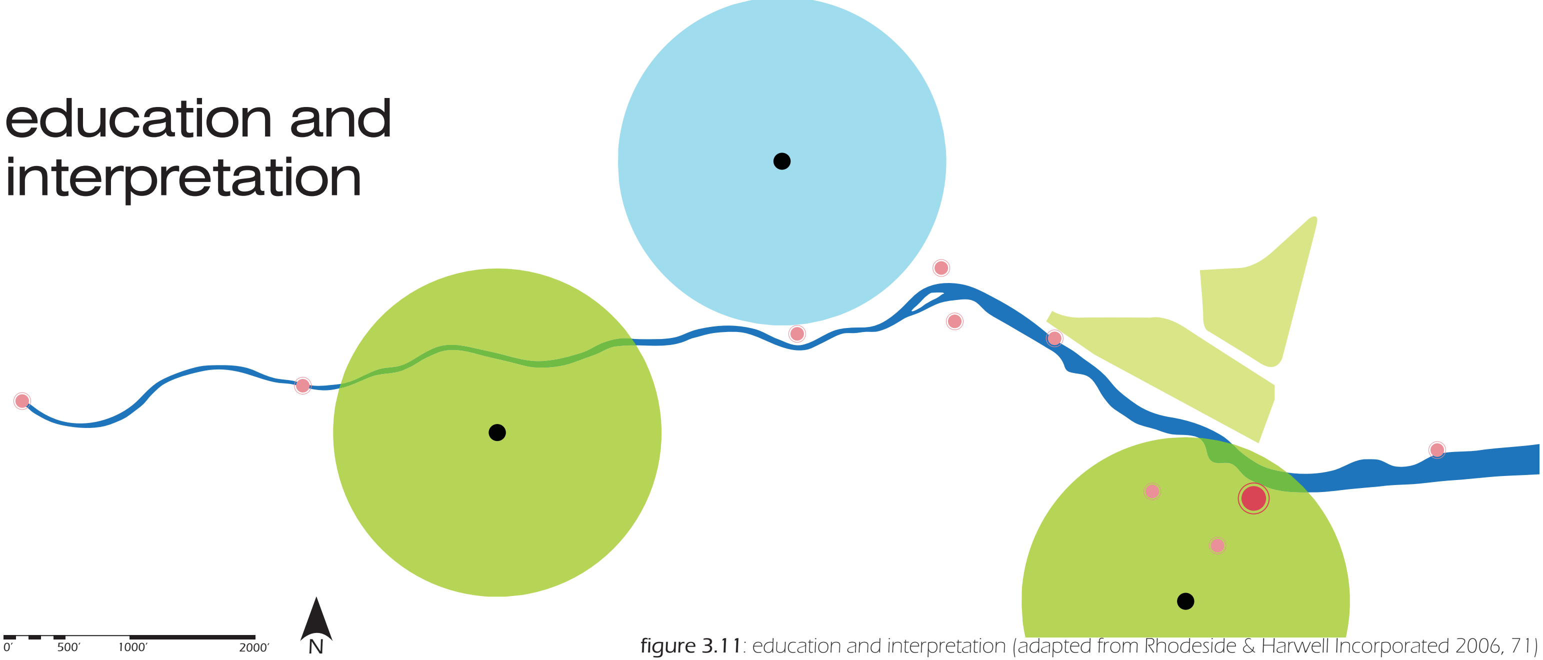


figure 3.11: education and interpretation (adapted from Rhodeside & Harwell Incorporated 2006, 71)

legend

- integrated native planting
- demonstration wetlands
- integrated wetlands
- pedestrian/ cyclist bridge
- dock

figure 3.12: education and interpretation perspective 1 (adapted from Rhodeside & Harwell Incorporated 2006, 44)

legend

- elementary school
- middle school
- water pollution control plant
- nature - culture center
- interpretation/ educational component
- school site location
- four mile run

Stress the interrelatedness of positive individual, institutional, and political actions and behavior changes with improved water quality and habitat in the corridor.

The Four Mile Run corridor will provide both the community and the region with a living classroom in which to learn about ecology, stream geomorphology, water quality, habitat protection and restoration, recycling and other topics.

The education and interpretation will:

• Provide interpretive opportunities to educate and inform the public about the stream corridor.
• Create a place for people to understand their connection with water and nature within an urban context.
• Interpret the principles of "green design" in ways that underscore the important linkages between design, use and sustainability.

(Rhodeside & Harwell Incorporated 2006, 71-72)

Design goals:

Create a learning environment along the full extent of the Four Mile Run corridor - interpretive elements consist of signs, display boards, pavement markings, art pieces, water features, play structures, tour brochures, and guided tours

Emphasize the joy of learning about the corridor and the community - several facilities are dedicated to interpreting the corridor and to having fun while learning

Establishing a partnership with local schools - the corridor acts a laboratory in which to explore environmental, cultural, historic and social issues that are part of the school curriculum for both the city and county

(Rhodeside & Harwell Incorporated 2006, 72)

figure 3.13: education and interpretation perspective 2 (adapted from Rhodeside & Harwell Incorporated 2006, 44)

legend

- multi-use and play area
- integrated wetlands
- multi-purpose field

phasing and cost estimates

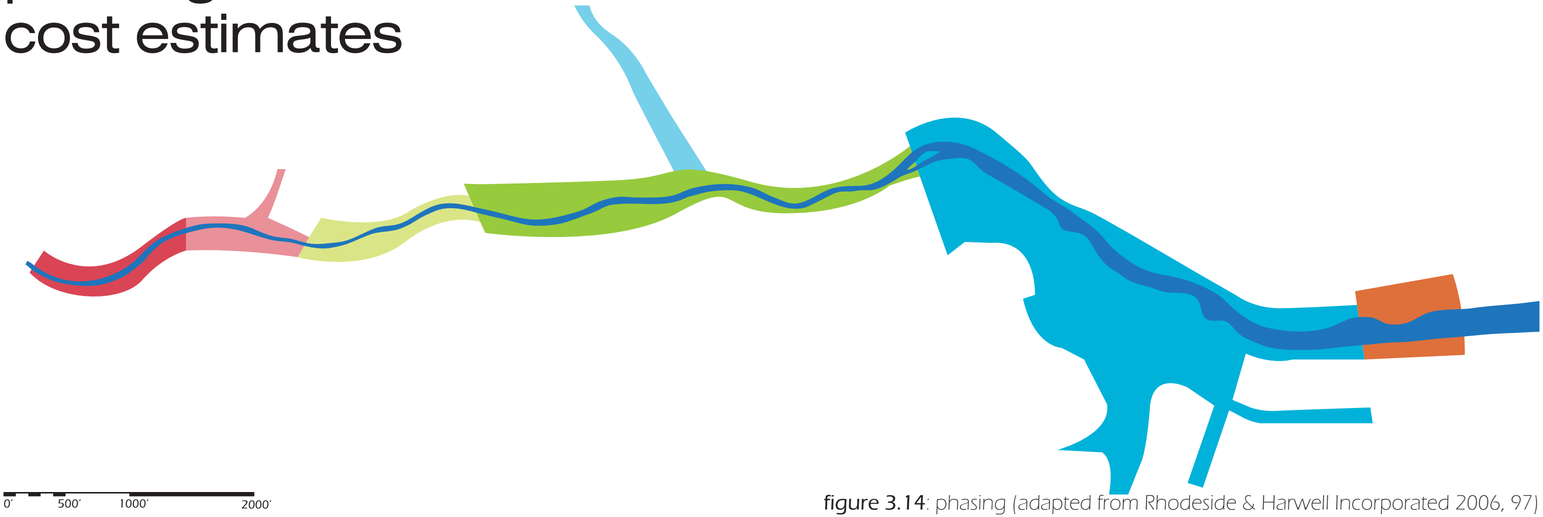


figure 3.14: phasing (adapted from Rhodeside & Harwell Incorporated 2006, 97)

demonstration project

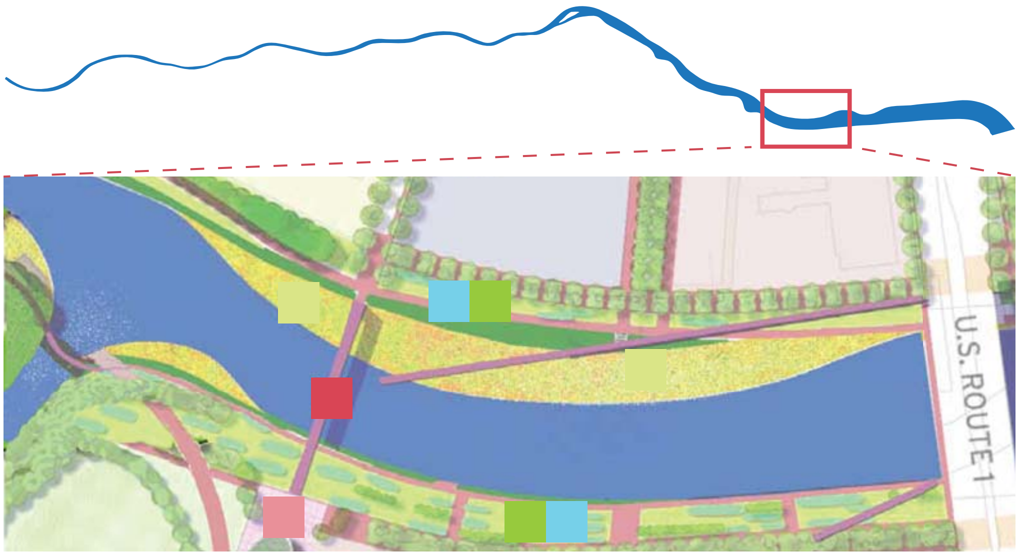


figure 3.15: demonstration project (adapted from Rhodeside & Harwell Incorporated 2006, 97)

legend

- removal of gabions
- restoration of stream banks
- creation of wetland bar
- construction of pedestrian/ cyclist bridge
- information box and signage

figure 4.15: (adapted from Rhodeside & Harwell Incorporated 2006, 92)

legend

- area 1 - $15,000,000
- area 2 - $12,000,000
- area 3 - $9,000,000
- area 4 - $86,000,000
- area 5 - $5,000,000
- area 6 - $116,000,000
- area 7 - $18,000,000
- four mile run

Demonstration Project:
- demolition of gabions and disposal of debris
- stream restoration and reforestation
- wetland bars
- litter control
- site furnishings
- information box and signage

Subtotal Cost $1,000,000

Components in anticipation of additional funds:
- pedestrian/bicyclist bridge crossing stream between South Eads Street and Commonwealth Avenue
- associated lighting
- temporary interim connecting trails

Subtotal Cost $5,900,000

(ramps and promenades will not be constructed as a part of the demonstration project)

TOTAL COST $6,900,000

Area 1:
- demolition of riprap and debris
- stream restoration and reforestation
- pedestrian/bicyclist promenade
- stormwater management components
- step-pools
- site furnishings and lighting

TOTAL COST $15,000,000

Area 2:
- demolition of riprap, debris and portions of concrete flood walls
- stream restoration and reforestation
- pedestrian/bicyclist promenade
- stormwater management components
- site furnishings and lighting
- aesthetic upgrades to underside of I-395

TOTAL COST $12,000,000

Area 3:
- demolition of gabions and removal of riprap
- stream restoration and reforestation
- stormwater management components
- site furnishings and lighting
- trails and walkways

TOTAL COST $12,000,000

Area 4:
- removal of existing West Glebe Road vehicular bridge
- demolition of portions of West Glebe Road
- new multi-purpose field
- south Glebe Road realignment
- new vehicular bridge
- new pedestrian/ bicyclist bridges
- demolition of gabions and portions of floodwalls and disposal of debris
- stream restoration and reforestation
- stormwater management components
- site furnishings and lighting
- trails and walkways

TOTAL COST $86,000,000

Area 5:
- stream restoration and reforestation
- stormwater management components
- site furnishings and lighting
- trails and walkways
- removal of riprap and disposal of debris

TOTAL COST $5,000,000

Area 6:
- Commonwealth Avenue improvements
- new road from US Route 1 to Four Mile Run Park
- Mount Vernon Avenue improvements
- Nature Center
- new pedestrian/ bicyclist bridges
- demolition of gabions
- stream restoration and reforestation
- wetland bar creation
- Four Mile Run Park wetland enhancements
- stormwater management components
- site furnishings and lighting
- trails and walkways
- removal of riprap and disposal of debris
- new sports fields and associated facilities
- public plaza
- flood control structure

TOTAL COST $116,000,000

Area 7:
- demolition of one disused rail bridge
- demolition of gabions and disposal of debris
- public plaza on remaining rail bridge
- stream restoration and reforestation
- wetland bar creation
- promenades
- stormwater management components
- site furnishings and lighting
- trails and walkways

TOTAL COST $18,000,000

(Rhodeside & Harwell Incorporated 2006, 98)

inventory. analysis

image source (Charles McDowell)

site inventory and analysis process

corridor study

The goals of the corridor study are to determine a specific site, or sites, that are suitable for design and development, and to prioritize the selected sites based on a select set of factors to determine an order for site exploration, design, and development. The study specifically addresses the project goals of Improve, Connect, and Educate. The corridor study is broken up into the Improve vulnerability study, the Connect suitability study, and the Educate suitability study.

The Improve vulnerability study is an inventory of the major factors affecting environmental vulnerability: current project status, in-stream conditions, degree of confinement, and flood prone areas.

The Connect suitability study is an inventory of the major factors affecting connectivity of the corridor: pedestrian circulation, near-stream conditions, adjacent and crossing roads, and population.

The Educate suitability study is an inventory of the major factors affecting the ability to educate the users of the corridor: special interest areas, green impact zone, schools, and population.

corridor analysis

The corridor analysis synthesizes the factors in the study in order to determine a site, or sites, and to prioritize them. The factors are weighted and combined, in an overlay method, in order to determine areas along Brush Creek that have the ability to achieve the project goals. This process is done for each analysis: the Improve vulnerability analysis, the Connect suitability analysis, and the Educate suitability analysis.

After each individual analysis is completed, they are synthesized and sites are selected and prioritized for further design and development.

site study

The goals of the site study were to program the spaces to optimize on surrounding cultural and natural resources, and to implement site specific ecological and eco-revelatory designs that achieve the project goals and respond to the cultural and natural resources. In order to program the site a matrix looking at function, form, economy, and time was related to goals, facts, concepts, needs, and problems. A potential program was then developed and expanded upon to create a list of actual program elements.

critical site conditions

In order to achieve the project goals, critical existing site conditions were evaluated. Each condition had a major impact on implementing the goals of Improve, Connect, and Educate. These conditions include: elevation, slopes, visibility, historic stream pattern, existing vegetation, circulation.

corridor study process

IMPROVE local environmental conditions through ecological design

manage localized flooding to reduce flash flooding

increase stormwater infiltration

improve water quality within brush creek

CONNECT the corridor for improved pedestrian use

create a design language that can be implemented throughout the corridor

improve access to the corridor

link the existing corridor projects

EDUCATE users to the environmental benefits of ecological design

target selected user groups that could have a potential association with the project

link up with existing environmental improvement goals and initiatives

implement innovative strategies for environmental education

REVEAL and interpret ecological processes and phenomena through design

promote environmental stewardship subconsciously through experience

explore new means for conveying environmental education

allow users to create their own relationship with the natural world in a designed setting

corridor study

DETERMINE a specific site, or sites, that are suitable for design and development

PRIORITIZE the selected sites based on a select set of factors to determine an order for site exploration, design, and development

site study

PROGRAM the spaces to optimize surrounding cultural and natural resources

IMPLEMENT site specific ecological and eco-revelatory designs that achieve the project goals and respond to the cultural and natural resources

stream reach classification

the city of kansas city, missouri has classified nine different reaches of brush creek between state line road and the blue river

these classifications were based on many factors include in-stream conditions, near-stream conditions, and much more

for the corridor study, the classifications formed by kcmo will be used

the reaches are:

west plaza
plaza reach
troost reach
the paseo complex
woodland reach
bruce r. watkins
prospect reach
lake of the enshriners
confluence with blue river

key questions

factors to be considered

IMPROVE

what reaches of the Brush Creek Corridor have the highest vulnerability to environmental degradation?

VULNERABILITY

	physical stream reach
where are the completed channel design projects?	current project status
in what reaches are the channel design projects in a dilapidated state?	in-stream conditions
what stream reaches show negative impacts from the flows of brush creek?	in-stream conditions
what is the degree of development adjacent to the stream?	degree of stream confinement
what areas would be influenced by a 100 or 500 year flood?	flood-prone areas
what areas or buildings in the adjacent drainages are consistently flooded?	flood-prone areas

CONNECT

what areas along the Brush Creek Corridor have the highest potential for connecting the corridor?

SUITABILITY

	physical adjacent area
at what points does the corridor lack connections between projects?	pedestrian circulation
where are the pedestrian access points to the stream corridor?	pedestrian circulation
what parks or pedestrian oriented spaces are adjacent to the stream?	near-stream conditions
what major barriers parallel the stream?	near-stream conditions
what are the parallel roads that act as barriers to the stream corridor?	adjacent and crossing roads
what crossing roads act as barriers to the stream corridor?	adjacent and crossing roads
where are the highest densities of people living around the corridor?	population

EDUCATE

what areas along the Brush Creek Corridor have the highest potential to take advantage of environmental educational opportunities?

SUITABILITY

	social adjacent area
what relationships do organizations such as the kc art institute or the anita b. gorman discovery center have with the corridor?	special interest areas
what areas can directly or indirectly relate to the country club plaza?	special interest areas
do the goals and objectives of the green impact zone align with this project?	green impact zone
what schools have the closest physical connection to the stream corridor?	schools
what type of school (elementary, middle, high, university; public vs. private) would best create an educational connection with the project?	schools
where are the highest densities of select demographics, such as ages 5 to 17, located in relationship to the corridor?	population

site study

figure 4.1: corridor study process (Charles McDowell)

weighting and synthesis summary

improve connect educate
weighting for study

necessary improvements
cost of improvements
pedestrian circulation
existing infrastructure
flood potential
existing vegetation
high
current project status

visual aesthetics
stream alignment
stream form
conveyance speed
flood potential
vegetation
moderate
in-stream conditions

visibility
enclosure
flood management
designed area
points of access
parking
moderate
degree of stream confinement

flood management
extent of floodplain
areas of inundation
designed area
maintenance requirements
vegetation
low
flood prone areas

improve
vulnerability study

improve connect educate
weighting for study

adjacent connections
pedestrian crossings
points of access
parking
designed area
visibility
high
pedestrian circulation

adjacent connections
neighborhood connections
in-corridor adjacencies
existing infrastructure
designed area
parking
moderate
near-stream conditions

safety
lighting
pedestrian crossings
adjacent connections
in-corridor connectivity
parking
high
adjacent and crossing roads

adjacent connections
neighborhood connections
points of access
visibility
user demographics
walking distances
low
population (density)

connect
suitability study

improve connect educate
weighting for study

outdoor classrooms
demonstration sites
pedestrian crossings
performance/exhibit spaces
adjacent connections
visibility
moderate
special interest areas

community involvement
neighborhood connections
green initiatives
demonstration projects
community education
stormwater improvements
low
green impact zone

outdoor classrooms
demonstration sites
pedestrian crossings
performance/exhibit spaces
adjacent connections
visibility
high
schools

adjacent connections
neighborhood connections
routes to schools
pedestrian crossings
informal play areas
location of educational sites
low
population (ages 5-17)

educate
suitability study

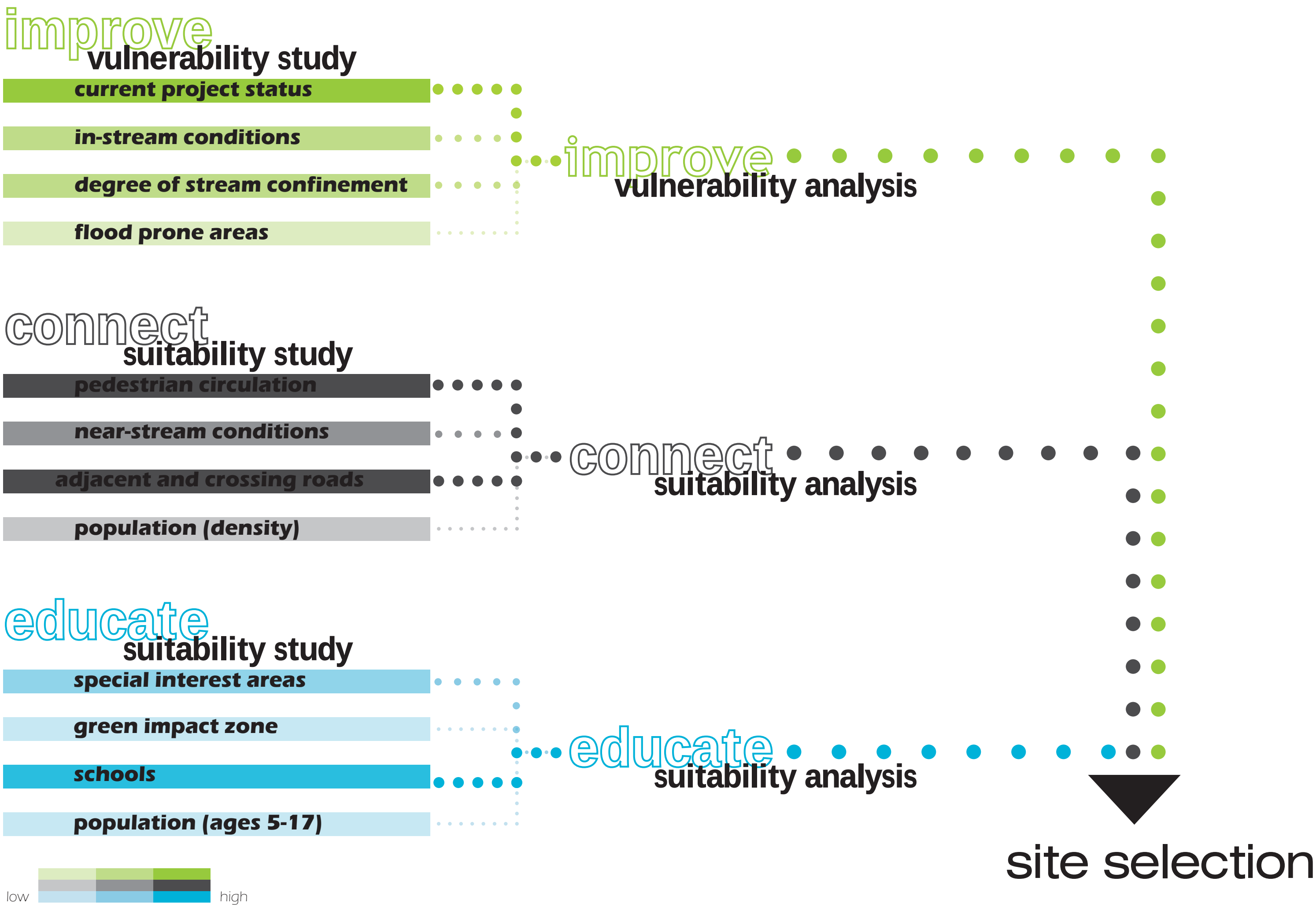


figure 4.2: weighting and synthesis summary (Charles McDowell)

improve vulnerability study

IMPROVE local environmental conditions through ecological design

manage localized flooding to reduce flash flooding

increase stormwater infiltration

improve water quality within brush creek

In order to address the main goals related to improving the ecological conditions in the corridor, a vulnerability study of existing conditions is necessary to determine potential sites. The factors considered in the improve vulnerability study are: current project status, in-stream conditions, degree of stream confinement, and flood prone areas. Since the vulnerability study focuses on in-stream conditions, sites will be selected based on the condition of the stream reach, this will lead to site identification.

improve
vulnerability analysis

The vulnerability analysis looks at four main factors relating to the ability to improve the environmental conditions in the Brush Creek Corridor: current project status, in-stream conditions, degree of stream confinement, and flood prone areas. These four factors have been synthesized in order to determine specific sites that have the highest potential to improve.

This synthesis was done using an overlay method, and sites were identified based on the culmination of the four factors. Each of the four factors was weighted based on the value of each factor. Current project status has a high value, in-stream conditions has a moderate value, degree of stream confinement has a moderate value, and flood prone areas has a low value. The synthesis takes these three different values and applies them to the specific factor and overlays each factor, the outcome being the areas with the highest potential to improve.

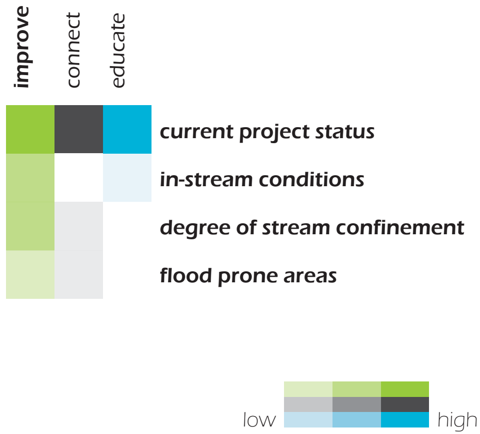
legend

high vulnerability to degradation

moderate vulnerability to degradation

low vulnerability to degradation

highest potential - site selection



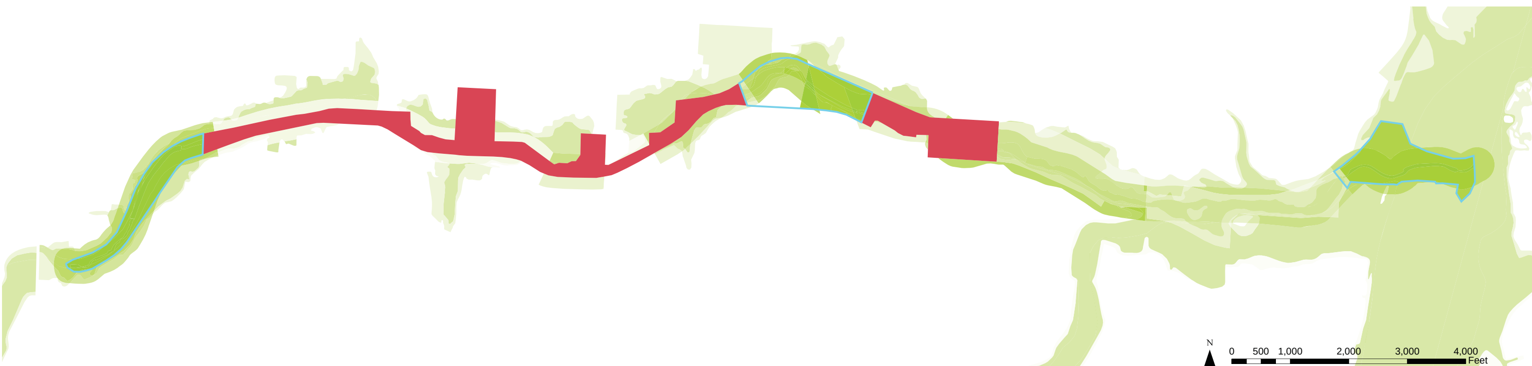


figure 4.3: improve - vulnerability analysis (Charles McDowell)

connect suitability study

CONNECT the corridor for improved pedestrian use

create a design language that can be implemented throughout the corridor

improve access to the corridor

link the existing corridor projects

In order to address the main goals related to connecting the corridor, a suitability study of existing conditions is necessary to determine potential sites. The factors considered in the connect suitability study are: pedestrian circulation, near-stream conditions, adjacent and crossing roads, and population. Since the suitability study focuses on near-stream conditions, sites will be selected based on the condition of the area adjacent to Brush Creek and a general area will be identified for site selection.

connect suitability analysis

The suitability analysis looks at four main factors relating to the ability to connect users to and within the Brush Creek Corridor: pedestrian circulation, near-stream conditions, adjacent and crossing roads, and population. These four factors have been synthesized in order to determine specific sites that have the highest potential to connect.

This synthesis was done using an overlay method, and sites were identified based on the culmination of the four factors. Each of the four factors was weighted based on the value of each factor. Pedestrian circulation has a high value, near-stream conditions has a moderate value, adjacent and crossing roads has a high value, and population has a low value. The synthesis takes these three different values and applies them to the specific factor and overlays each factor, the outcome being the areas with the highest potential to connect.

legend

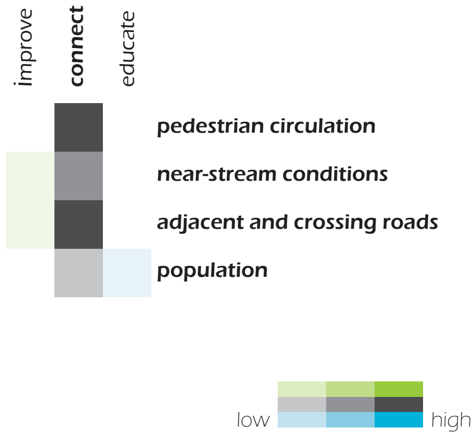
high potential for connection

moderate potential for connection

low potential for connection

barrier - highest disconnect

highest potential - site selection



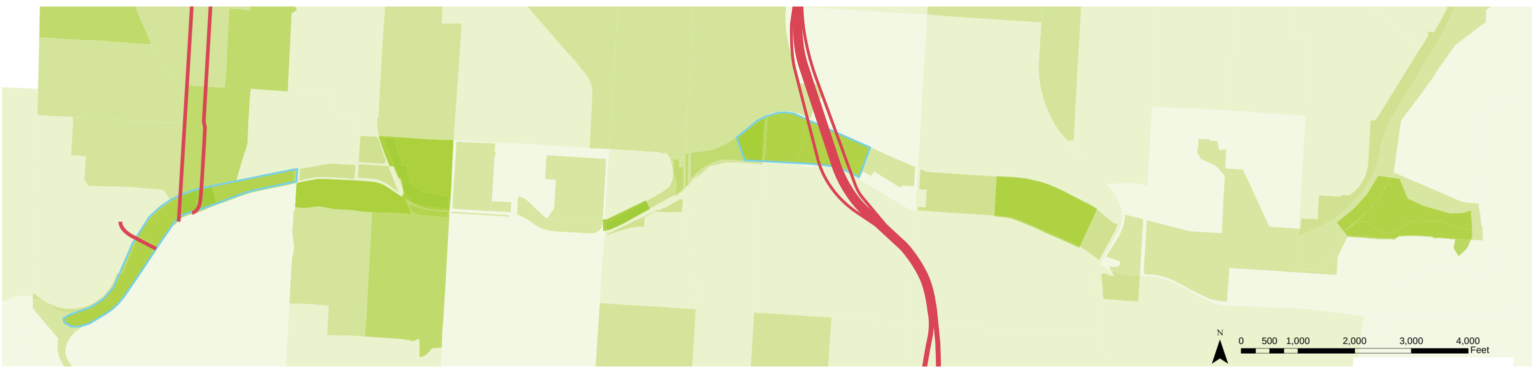


figure 4.4: connect - suitability analysis (Charles McDowell)

educate suitability study

EDUCATE users to the environmental benefits of ecological design

target selected user groups that could have a potential association with the project

link up with existing environmental improvement goals and initiatives

implement innovative strategies for environmental education

In order to address the main goals related to educating the users of the corridor, a suitability study of existing conditions is necessary to determine potential sites. The factors considered in the educate suitability study are: special interest areas, the green impact zone, schools, and population. Since the suitability study focuses on near-stream conditions, sites are selected based on the condition of the area adjacent to Brush Creek and an area will be identified for site selection.

educate suitability analysis

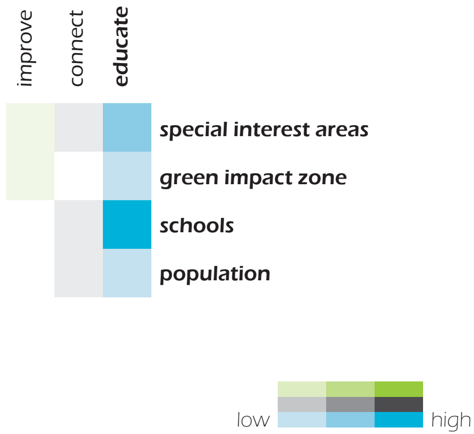
legend

high potential for education

moderate potential for education

low potential for education

highest potential - site selection



The suitability analysis looks at four main factors relating to the ability to educate users about the environment within the Brush Creek Corridor: special interest areas, the green impact zone, schools, and population. These four factors have been synthesized in order to determine specific sites that have the highest potential to educate.

This synthesis was done using an overlay method, and sites were identified based on the culmination of the four factors. Each of the four factors was weighted based on the value of each factor. Special interest areas have a moderate value, green impact zone has a low value, schools have a high value, and population has a low value. The synthesis takes these three different values and applies them to the specific factor and overlays each factor, the outcome being the areas with the highest potential to educate.

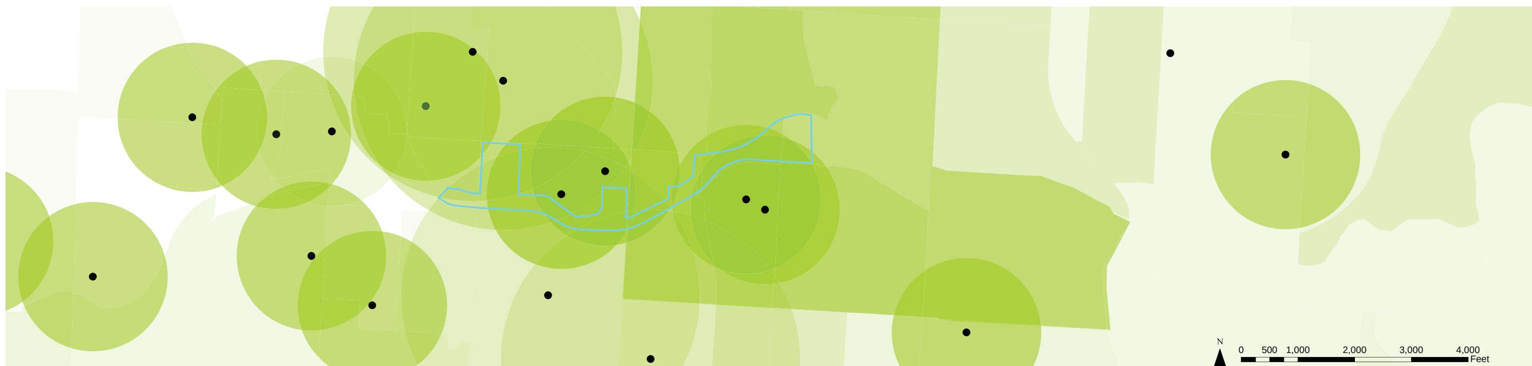


figure 4.5: educate - suitability analysis (Charles McDowell)

site selection

In order to make the final site selection, the improve vulnerability study, the connect suitability study, and the educate suitability study were synthesized. The sites identified in each individual study were overlaid to see the overlaps and where the sites with the most potential are located. The areas of the corridor where there are completed projects, identified in the current project status diagram, are projected to show which areas of the corridor will not be considered for site selection.

There are three clear areas defined for site selection: Woodland/ Bruce R. Watkins, West Plaza, and Confluence with the Blue River. Using an overlay method, priorities are defined for the sites based on each sites ability to best achieve the project goals. The highest priority being Woodland/ Bruce R. Watkins, with West Plaza being second priority, and lastly the Confluence with the Blue River.

legend

- high potential for addressing goals
- moderate potential for addressing goals
- no potential for educational orientation
- conflicting potentials - no potential
- brush creek
- corridor study boundary
- highest potential - site selection

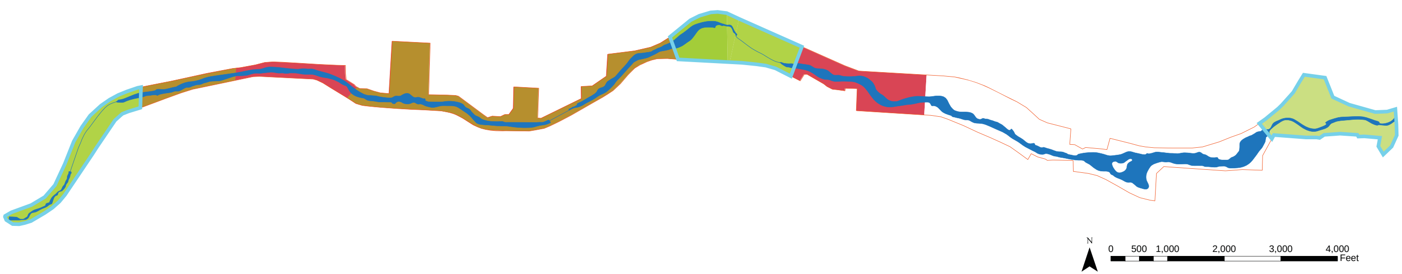


figure 4.6: site selection analysis (Charles McDowell)

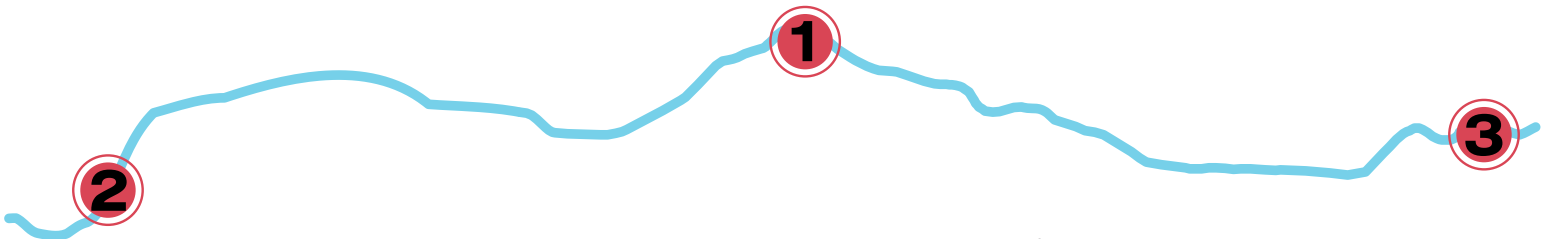


figure 4.7: site selection prioritization (Charles McDowell)

West Plaza

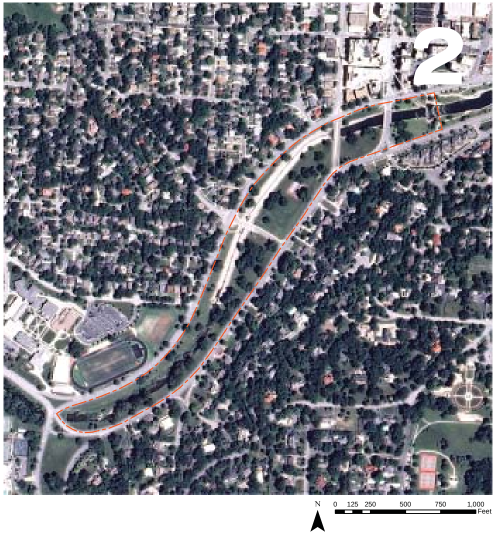


figure 4.8: west plaza (MSDIS)

Bruce R. Watkins . Woodland

figure 4.9: bruce r. watkins. woodland (MSDIS)

Confluence With Blue River

figure 4.10: confluence with blue river (MSDIS)

site study process

PROGRAM the spaces to optimize surrounding cultural and natural resources

IMPLEMENT site specific ecological and eco-revelatory designs that achieve the project goals and respond to the cultural and natural resources

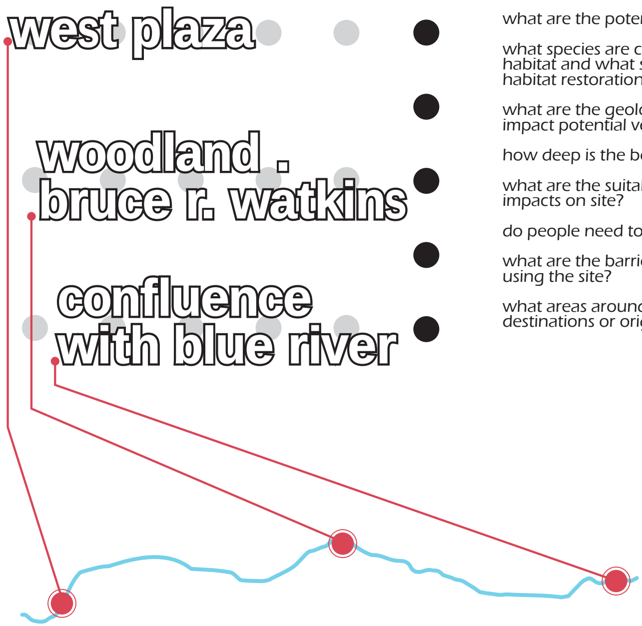


figure 6.1: site locations diagram (Charles McDowell)

key questions

how did brush creek flow in the past?

where did brush creek flow in the past and what was it's influence on the site?

is there potential for extended water infiltration or wetlands on the site?

where was the historical floodplain located and in what state is the floodplain currently in?

what are the historical and current vegetation patterns?

what are the potential riparian habitats?

what species are currently using the corridor for habitat and what species can be targeted for habitat restoration?

what are the geologic materials and how can that impact potential vegetation?

how deep is the bedrock beyond the surface?

what are the suitable areas to mitigate flood impacts on site?

do people need to cross brush creek on the site?

what are the barriers inhibiting pedestrians from using the site?

what areas around the site are potential destinations or origins of pedestrian traffic?

factors to be considered

historic stream form
historic stream alignment
depressions
steep slopes
existing vegetation
historic vegetation patterns
wildlife/habitat potentials
surface geology
bedrock geology
soils- moisture holding capacity
flood-prone areas
pedestrian/vehicular circulation
physical/social barriers
surrounding destinations

program potential

IMPROVE
in-channel modifications
flood control
stream bank stabilization
stormwater management
vegetation and habitat

CONNECT
circulation and connection
stream crossings
destinations and activities
recreation
security

EDUCATE
demonstration projects
interpretation
outdoor education

REVEAL

site identification

figure 4.11: site study process (Charles McDowell)

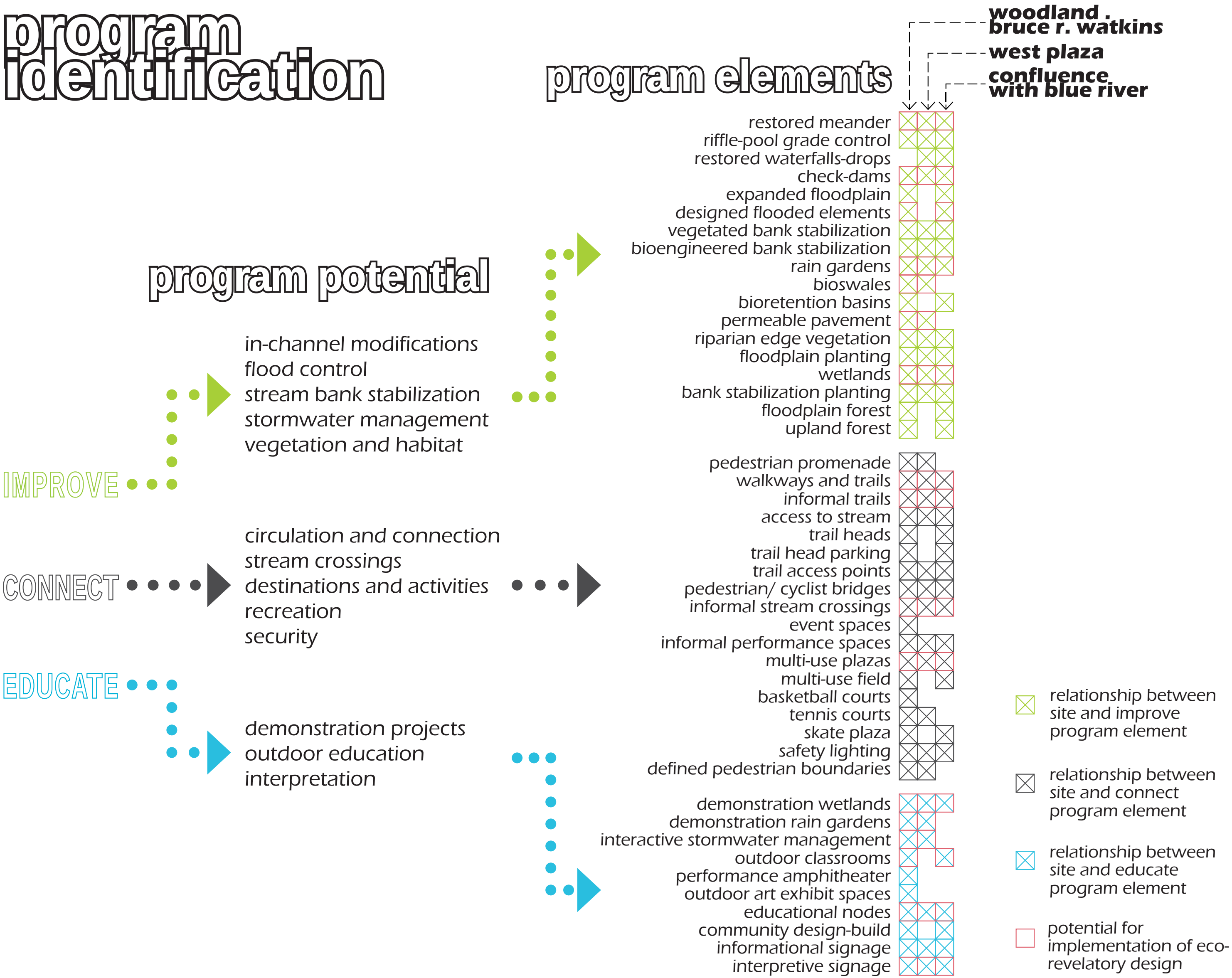


figure 4.12: program identification process (Charles McDowell)

woodland.
bruce r. watkins

The Woodland/ Bruce R. Watkins site was determined to have the highest potential for improving, connecting, and educating within the entire corridor. Because of this, the site is the top priority for programming, design, and development. It has the highest potential to improve the environmental quality of the corridor because it contains a section of Brush Creek that is natural but degraded and another section that is concrete lined. The site can connect the corridor because currently it is a barrier inhibiting the connection of the project sites to the east and the west. The site has the highest potential to educate because it is located adjacent to The Paseo Academy of the Performing Arts and the Kansas City Middle School of the Arts and within walking distance of the Anita B. Gorman Discovery Center. These two schools may take special interest in environmental educational opportunities within walking distance of the site.

The potential program and program elements will address these potentials and directly relate to the ability for the site to implement strategies that Improve, Connect, and Educate. At this scale, the goal of reveal is introduced and eco-revelatory design strategies will be implemented in conjunction with the three main project goals.

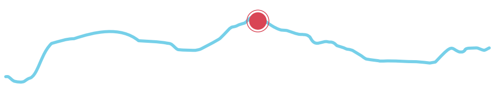


figure 4.13: location diagram (Charles McDowell)

figure 4.14: woodland . bruce r watkins - aerial image (MSDIS)

	goals	facts	concepts	needs	problems
function	create an environment focusing on the user while integrating the ecological functions of the site	the projects currently located in the corridor do not address ecological issues in pedestrian oriented areas	implement ecological design strategies with pedestrian use areas	native vegetation, restored natural processes, user oriented spaces	users might see the areas as messy and unsafe
	provide points of access to the corridor	access to the site is currently limited to one parking area on the south side	implement trail heads, and off-street connections into the corridor	trail heads, parking, signage	the design elements must relate to the urban quality of the corridor
	connect project areas to the east and west through the site	there are completed projects on either side of the site that are not currently connected to each other	implement a network of trails and walkways extending through the site	trails, walkways	linking the existing walkway system
	provide a safe atmosphere for recreation and passive use	the site currently lacks lighting and other safety features for night time use	use design elements such a lighting to promote usage at night time	lighting along walkways and under bridges	lighting in natural areas can be detrimental to habitat
	provide multiple recreation opportunities to users	the site has four tennis courts and this is the only recreational opportunity on site	provide multiple activities within the site including ball fields, courts, and passive recreation opportunities	multi-use field, basketball courts, walkways	the site has a limited amount of space to implement large scale elements like ball fields
	provide community gathering spaces	there are community organizations and schools surrounding the site	create muti-use plazas and greenspace	plazas, open fields, and pedestrian bridge	its hard to target a specific audience using multi-use spaces
	promote environmental education through eco-revelatory design strategies		design areas that directly respond to the ecological tendencies of the site	wetlands, native planting, integrated pedestrian spaces	
	connect to local schools and the discovery center	The Paseo Academy of the Performing Arts, the Kansas City Middle School of the Arts, and the Anita B. Gorman Discovery Center are located within a quarter mile of the site	create physical connections between the schools adjacent to the site	road crossings, signage, pedestrian bridge	circulation and connection can be controlled on the site but not from the schools
form	improve the in-stream systems to promote a healthy urban stream ecosystem	the current in stream conditions are degraded natural and concrete lined	recreate a stream meander, recreate a natural step-pool system	stream-channel design, in-stream vegetation	if the system is not established the channel design may be unstable
	improve near-stream conditions to promote a healthy urban stream ecosystem	the floodplain has been reduced because the site was a fill site for previous excavation projects	expand the current floodplain and integrate a natural floodplain and riparian planting palette	floodplain excavation, native vegetation	the site is a fill site with a large buildup of soil on the south side of Brush Creek
	integrate human and natural systems to promote a dynamic urban environment	there is no access to the stream system and pedestrian access is limited to the tennis courts and parking	create a trail and open space system that embraces natural systems and as an integral part of the design	trails that go through wetlands, native plantings, and other eco-design areas	some users might see the areas as messy and unsafe, maintenance may be costly
	define a pedestrian and natural edge to promote safety	currently there is an edge defined between riparian vegetation and mown lawn	determine a plant palette for natural and urban plantings	native plantings, traditional urban plantings	maintenance for natural areas will be costly
	create physical connections to other corridor projects	the site is a barrier to corridor connectivity	define different types and hierarchies of pedestrian circulation	promenades, walkways, trails, and informal trails	
	provide areas where education is the primary focus	the site is currently a single use recreational site	provide opportunities for formal and non formal outdoor education	outdoor classrooms, signage	if the sites are too specific to a single use the daily usage may be lacking
economy	minimize costs in relation to existing infrastructure	highway 71 and adjacent roads are the biggest barriers to the site	work within the existing confines of the site	design integrated into existing conditions	new systems my inhibit functionality of existing infrastructure
	create and maintain a system that reduces maintenance costs over the lifetime of the project	current maintenance costs are low and an improved stream system will be more economically viable over time	design a system that is dynamic but stable that can adjust over time	phasing and proper maintenance practices	natural systems have high maintenance requirements
	create opportunities for the community to manage the project as an investment	community involvement in the project will keep the project a priority in the community	involve the community from maintenance to community events	community involvement, community oriented spaces	community safety may be seen as an issue
	program the site for long term viability	constant use will promote long term success	program dynamic but practical spaces	dynamic and temporal spaces	year round use will be difficult
time	relate to the history of brush creek in order to reveal historical processes	Brush Creek has naturally changed and been modified throughout the recorded history of the corridor	reveal historical stream patterns of brush creek through design		users may not understand the link between the history and the design
	understand the development patterns of the corridor	the corridor is diverse in terms of development and some uses will increase in the future	relate to the surrounding areas including neighborhoods, businesses, and schools		neighborhoods, businesses, and schools are always changing
	envision what the corridor will look like in the future and respond to that vision	the urban environment is ever changing	relate to the surrounding urban environment through time		a truly stable stream system is highly dependant on the watershed
	understand the natural changes in stream systems and embrace those changes	stream systems have a natural process which will change the stream over time	design an active but stable stream channel that can change over time	in-stream area for the stream to shift	safety may be an issue
	plan for and respond to increased urbanization in the stream system	urbanization will to continue to increase near the site	Implement flood management design and relate materials and concepts to the urban user	design elements able to manage flooding, design language and palette	maintenance and cleanup will be costly

critical site conditions

elevation

Elevation information for the Woodland/ Bruce R. Watkins site is important in determining the ability to achieve the goal of improve. A major influence contributing to the site characteristics is highway 71 which was built up to bridge over the stream. The site was also used as dumping site for excess soil from upstream projects. This has created a large disconnect, in elevation, from the stream channel to the adjacent areas.

A few elements that may be influenced by the elevation and massing of the site are the ability to expand the floodplain, implement wetlands, work around existing infrastructure, along with the planting of particular vegetation and maintenance of habitats.

legend

High: 980 ft

contour interval: 1 meter

Low: 721 ft

site boundary

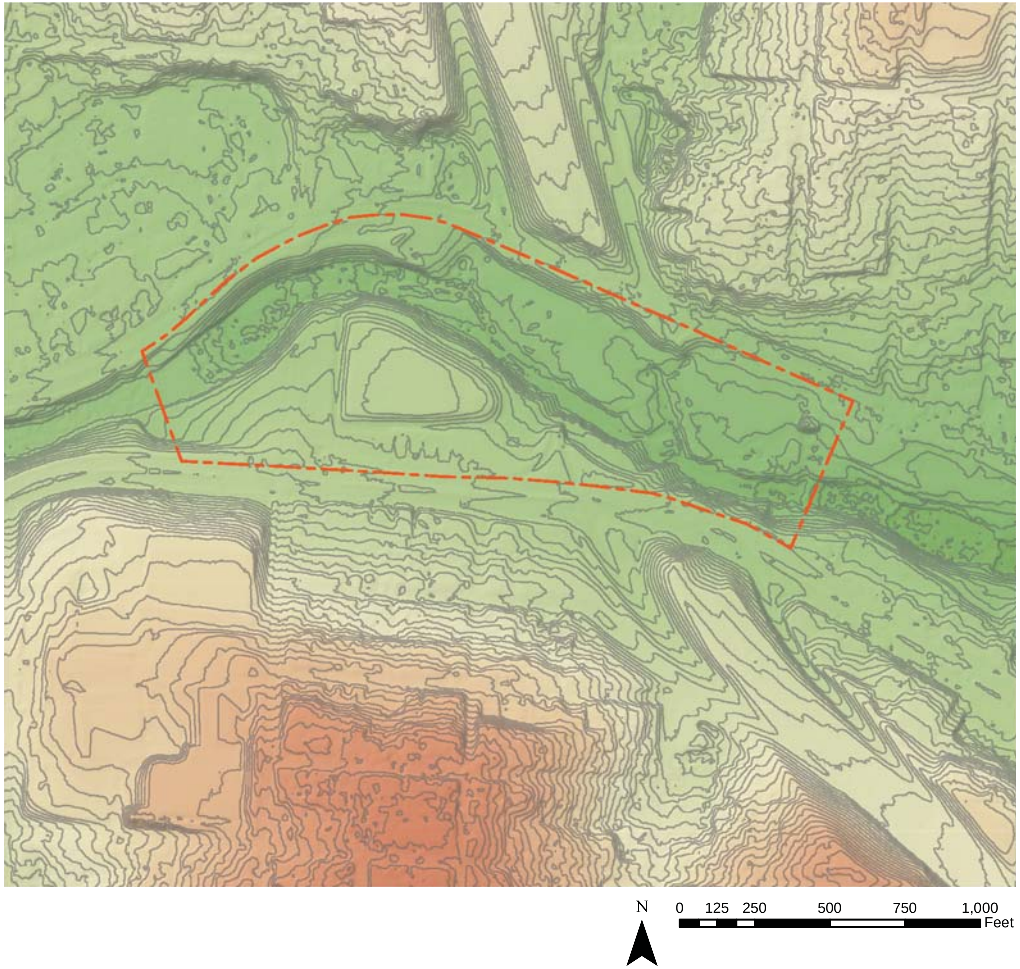


figure 4.15: elevation (adapted from Kansas DASC)

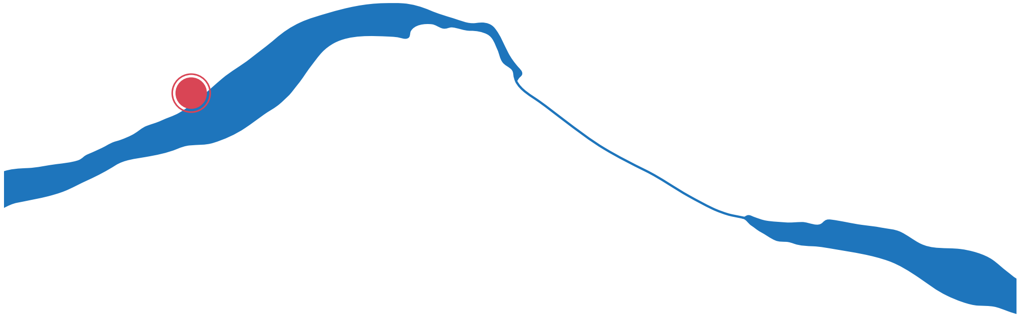


figure 4.16: image location (Charles McDowell)

figure 4.17: site image 1 (Charles McDowell)

slopes

Identifying key slope percentages for the Woodland/ Bruce R. Watkins site is important in determining the ability to achieve the project goals of improve and connect. Brush Creek has slopes steeper than 15 percent on its banks, and then levels out on the floodplain. As the land extends beyond the floodplain the slopes are steep and hilly. There are also steep slopes where the fills for highway 71 and the project dump site are located.

A few elements that may be influenced by the slopes are the ability to: expand the floodplain, access Brush Creek, implement trails and walkways, create multi-use open spaces. Other limitations would be the placement of vegetation and the maintenance of habitat.

legend

0.00 - 1.99 percent

2.00 - 4.99 percent

5.00 - 8.32 percent

8.33 - 14.99 percent

15.00 <

site boundary

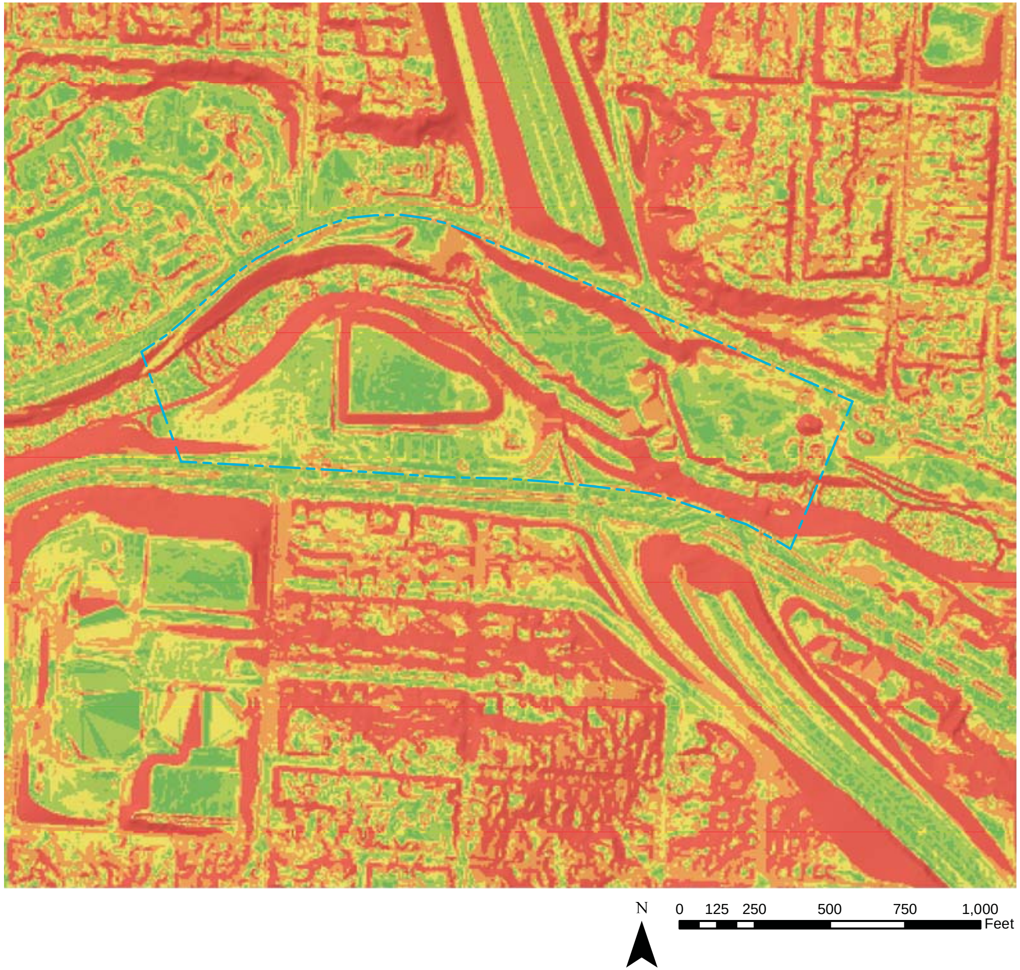


figure 4.18: slopes (adapted from Kansas DASC)

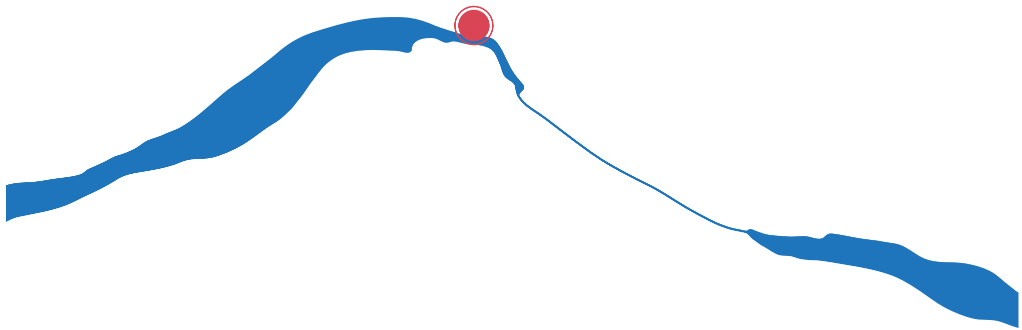


figure 4.19: image location (Charles McDowell)

figure 4.20: site image 2 (Charles McDowell)

existing vegetation

The majority of the site outside of the stream flood way is covered in mowed turf. There are a few large trees on the east side of highway 71. A few trees line the north and south border of the site. In-stream the vegetation is riparian woodland. Along the steep slopes, the grasses are overgrown and are not maintained with the rest of the turf.

legend

tree

riparian vegetation

site boundary

brush creek

figure 4.21: vegetation (Charles McDowell)

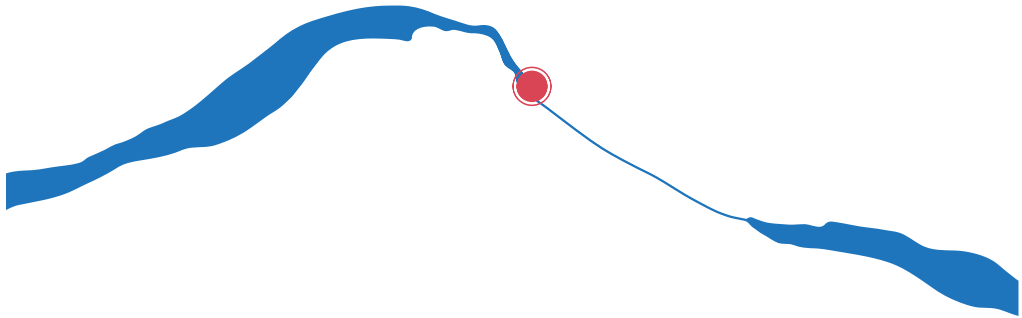


figure 4.22: image location (Charles McDowell)

figure 4.23: site image 3 (Charles McDowell)

circulation

Pedestrian circulation on the site is currently very limited. There are no through connections and the existing pathways dead end at the site. The major vehicular route through the site is Bruce R. Watkins Drive, also known as Highway 71. The highway is bridged over the corridor. The highway access roads also pass over the corridor on bridges. Emanuel Cleaver II Boulevard borders the north side of the site while Swope Parkway defines the southern side. There is currently a parking lot located on site, providing access to four tennis courts.

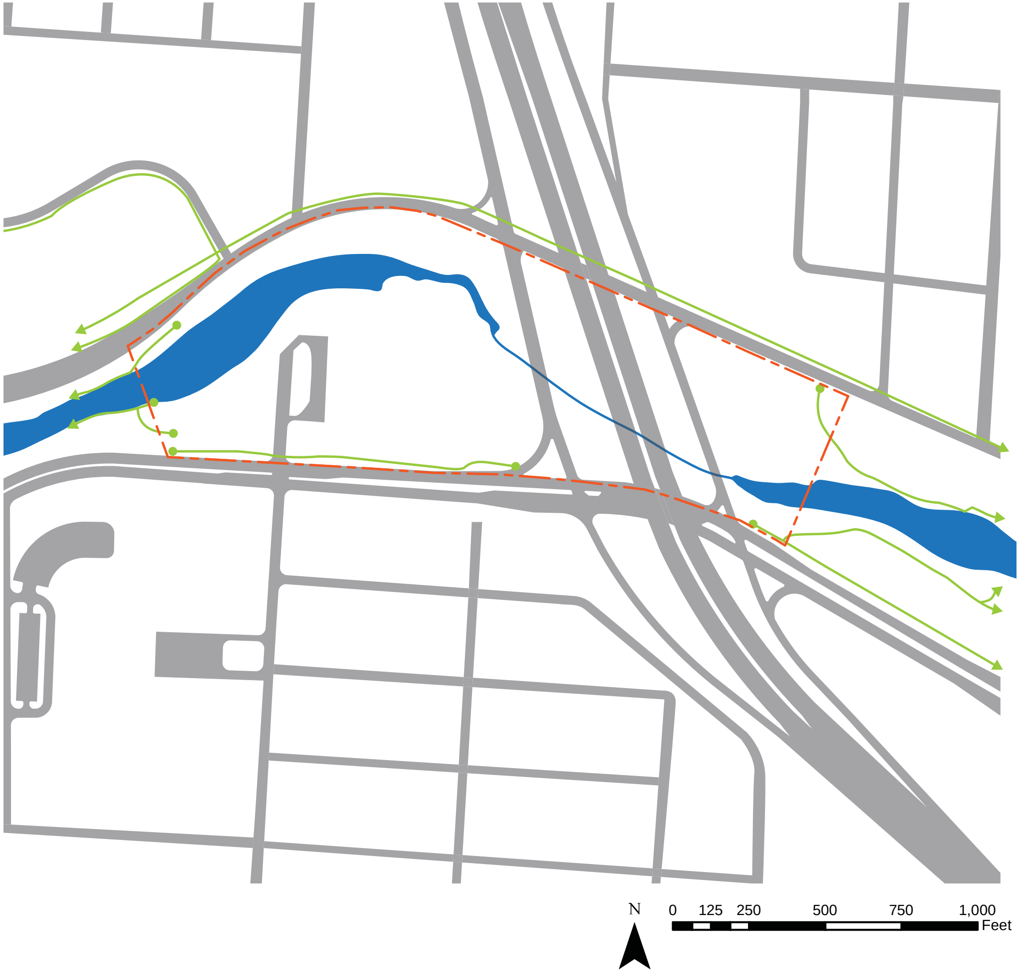


figure 4.24: circulation (Charles McDowell)

legend

pedestrian circulation

vehicular circulation

existing channel

site boundary

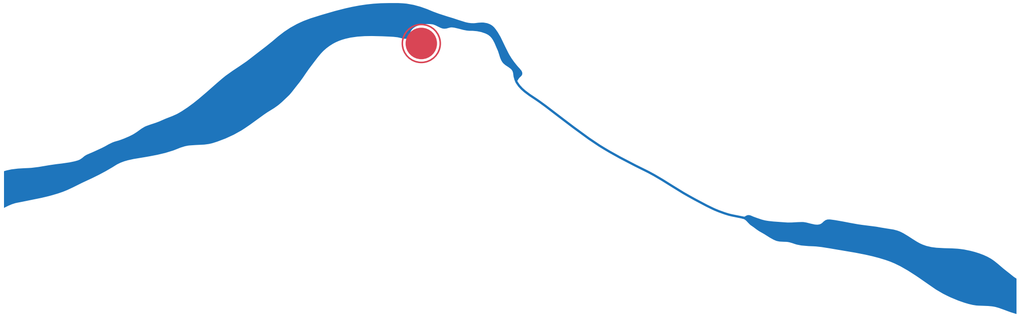


figure 4.25: image location (Charles McDowell)

figure 4.26: site image 4 (Charles McDowell)

visibility

Analyzing the visibility of Brush Creek for the Woodland/ Bruce R. Watkins site is important in determining the ability to achieve the goal of improve, connect, and educate. In order to create and maintain a successful project, visibility is extremely important. In order to gain interest and create excitement for this project, it must be seen on a daily basis. With Highway 71 crossing over it, and two major streets adjacent to it, Brush Creek and the designed area can be seen easily.

When improvements are made to Brush Creek, it is important that these areas are visible for people to understand the changes being made. This also helps with educating the public. The public first has to know the project is there to take an interest in it. In terms of connecting the corridor, it is important that public spaces and walkways are visible to potential users.

legend

visible

not visible

site boundary

brush creek

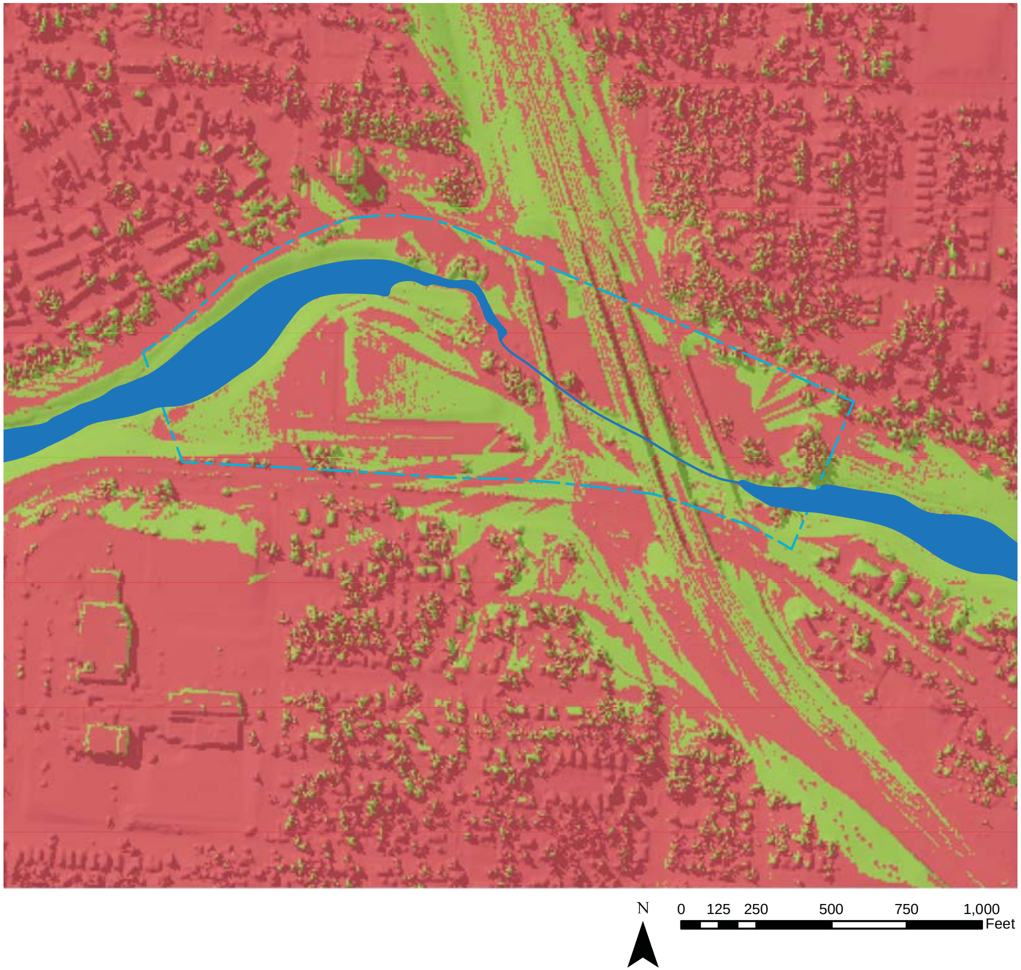


figure 4.27: woodland . bruce r watkins - visibility (adapted from Kansas DASC)

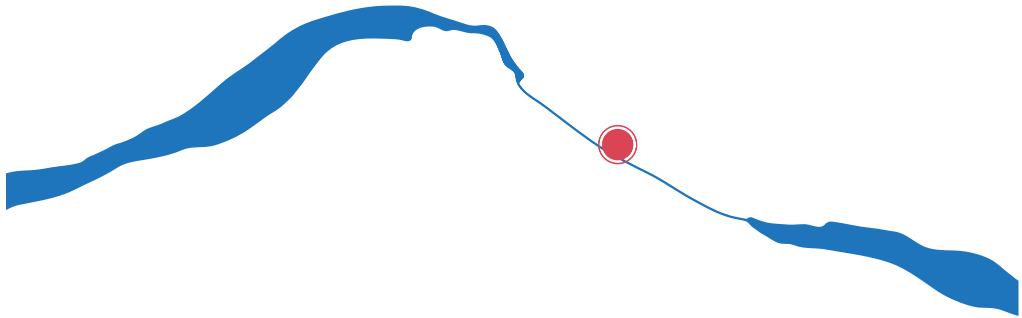


figure 4.28: image location (Charles McDowell)

figure 4.29: site image 5 (Charles McDowell)

historic stream pattern

Examining the historic stream pattern for the Woodland/ Bruce R. Watkins site is important in determining the ability to achieve the project goals of educate. The historical stream pattern was determined by examining a set of historical maps. The maps were overlaid and the Brush Creek center line was used as the stream path. The method for determining this is not completely accurate but does give a conceptual idea of the historical stream form and alignment. The understanding of the history of streams in urban environments, and in this case Brush Creek, can be conveyed to users.

legend

- 1887 stream center line
- 1907 stream center line
- 1912 stream center line
- 1915 stream center line
- 1917 stream center line
- 1921 stream center line
- 1935 stream center line
- existing channel
- site boundary

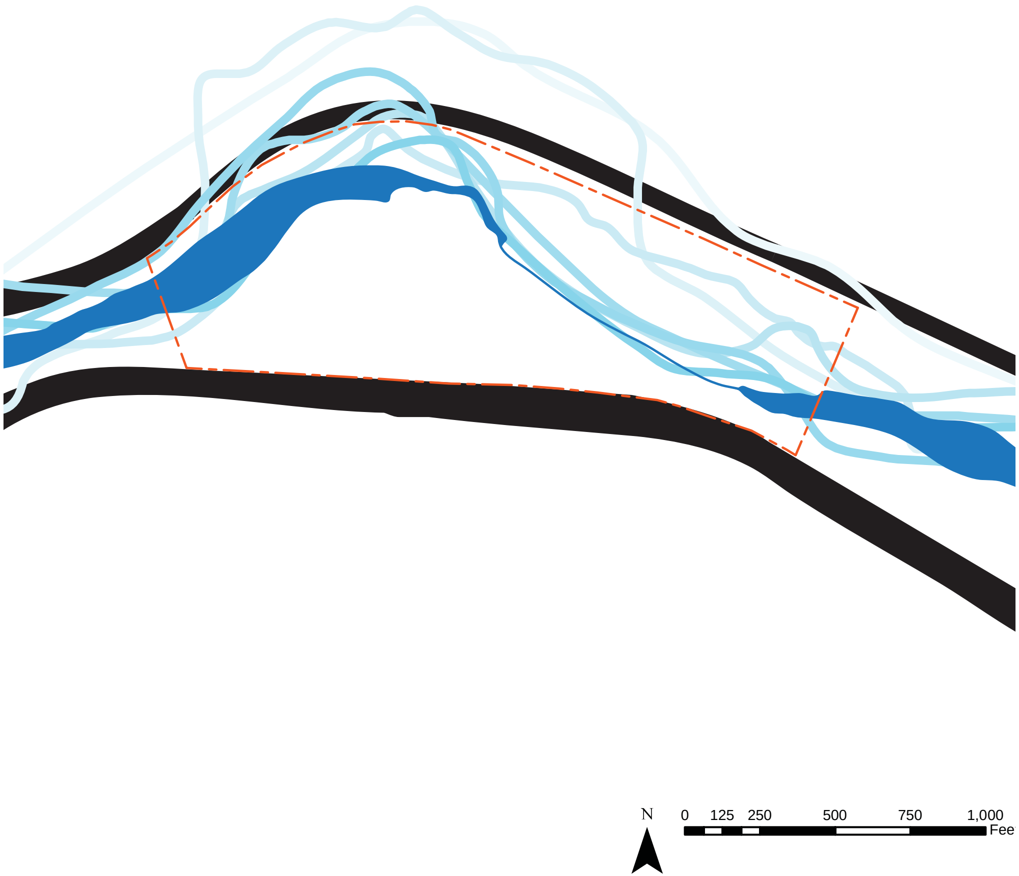


figure 4.30: historic stream pattern (Charles McDowell)

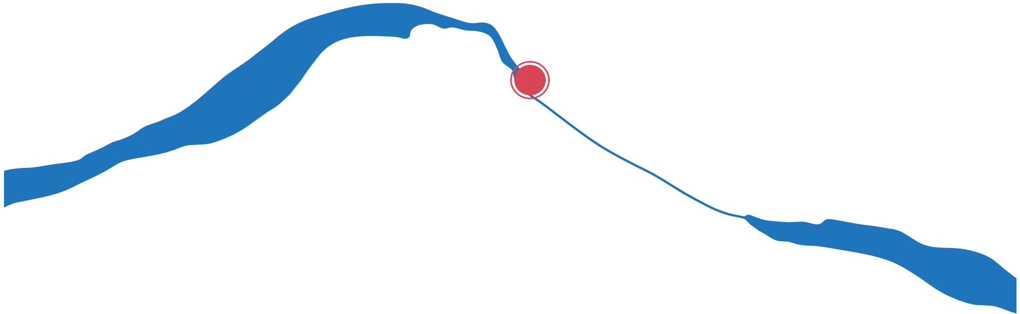


figure 4.31: image location (Charles McDowell)

figure 4.32: site image 6 (Charles McDowell)

design solution

image source (Charles McDowell)

introduction

The design solution for the Woodland/ Bruce R. Watkins site responds to the critical existing site conditions and directly addresses the need to: improve local environmental conditions through ecological design, connect the corridor for improved pedestrian use, and educate users to the environmental benefits of ecological design.

The existing condition that influenced the design response the most was the existing elevation of the stream and the amount of soil on site. Because of the challenges involved in earthwork manipulation, two design alternatives were developed to present solutions offering unique ways to address the design problem.

While attempting to maintain a general earthwork balance, each alternative responds to the same concept but manages the earthwork in different ways. Alternative One expresses the concept in a way that manipulates the site to create landforms which flow through the site. This alternative would involve considerable costs but creates a visitor experience that would be more memorable than that of Alternative Two. Alternative Two takes a more modest approach to the manipulation of the site in regards to landform. This alternative changes the site minimally while still achieving the project goals. This alternative would be a less costly solution to the problem than Alternative One.

The design alternatives respond directly to the project goals, and are presented in relation to the goals. Design Alternative One is presented followed by Alternative Two and finally a summary comparison of the two alternatives.

Each alternative first addresses the solution's response to the goal of improving local conditions through ecological design. The alternatives focus on in-stream conditions and near-stream conditions. The alternatives address the need to connect the corridor for improved pedestrian use by focusing on adjacent connections and in-corridor connections. The need to educate users to the environmental benefits of ecological design is conveyed through two overriding factors that are evident through the design: water and vegetation. Concluding the discussion of potential design solutions are earthwork, material, and cost estimates.

design concept

The concept for both alternatives is based on the movement of a stream within its confines. In urban situations, streams move vertically and laterally in response to changes in the watershed and adjacent areas. As confinement increases, streams move less. Below is a diagram of the Brush Creek Corridor that illustrates the migration of the channel between the 1880s and the 1930s. This migration relates to the site design concept which is seen though flowing landforms and vegetation patterns.

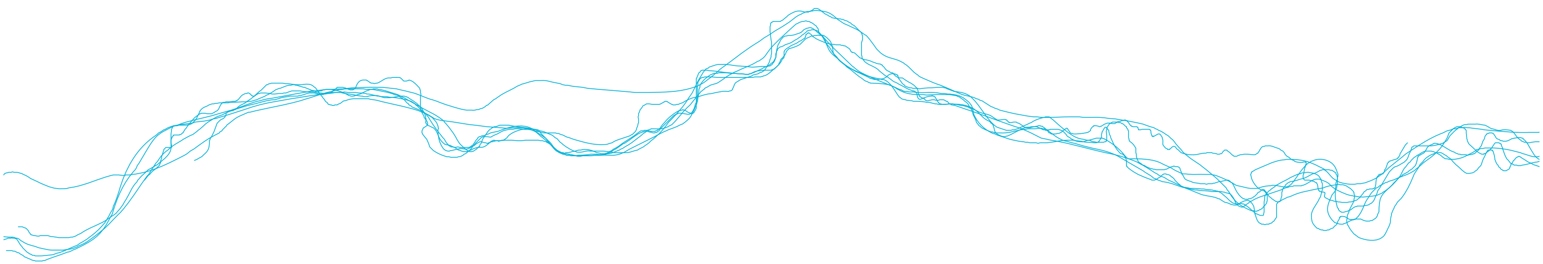


figure 5.1: design concept diagram (Charles McDowell)

alternative one

figure 5.2: alternative one master plan (Charles McDowell)

alternative two

figure 5.3: alternative two master plan (Charles McDowell)

figure 5.4: alternative one master plan (Charles McDowell)

alternative one

legend

1	parking area
2	rain garden
3	bioswale
4	open green space
5	primary walkway
6	plaza
7	constructed wetland
8	elevated outlook area
9	pedestrian bridge
10	deck overlook
11	wetlands
12	lowland area

scale: 1″ = 200′

0 50 100 200 300 500

improve

in-stream improvements

stream alignment

The alignment of Brush Creek is the location of the stream flow line. As Brush Creek currently flows, there is a drop in stream surface elevation of about a half a foot where the flood control project ends and the natural stream alignment begins. The proposed alignment will remove this drop allowing for a more natural meander further upstream. The concrete lined channel beneath the highway bridges is removed and the channel is able to move laterally within the confines of the structural columns of the highway.

legend

existing stream alignment

proposed stream alignment

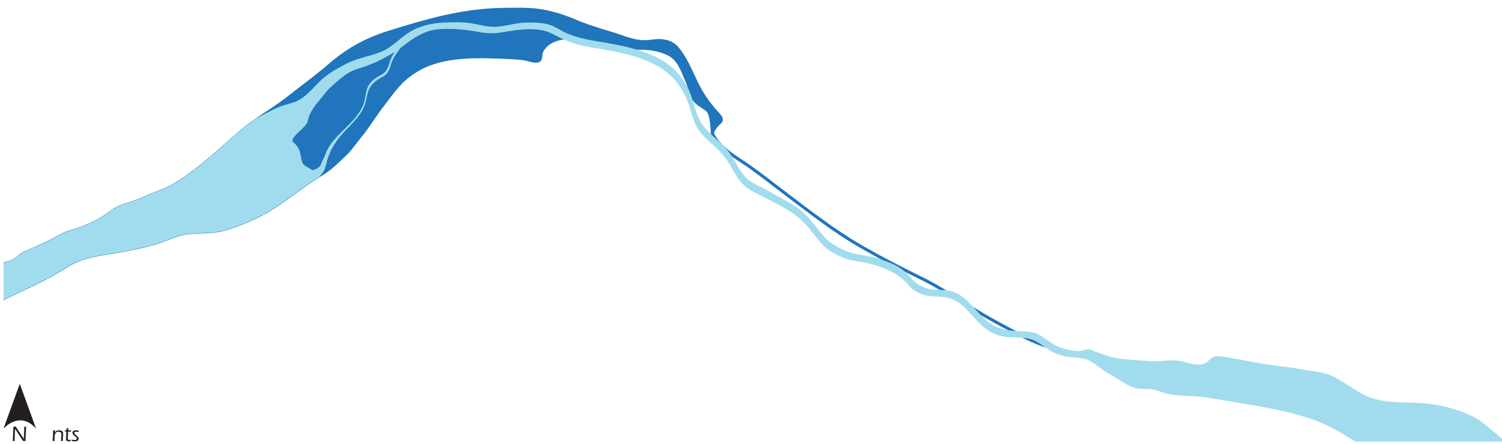


figure 5.5: stream alignment diagram (Charles McDowell)

stream form

The current condition of the form of Brush Creek ranges from channelized to control flooding, concrete lined, and naturalized. The proposed changes allow for Brush Creek to take a more natural form and to migrate and adjust to changes in flows over time. The proposal removes all concrete linings and restores Brush Creek to a natural form allowing for wetland bars and riparian vegetation to fill in along the stream. This proposal will allow for more infiltration, and filtration of the water as well as produce shelter and habitat where currently it is lacking.

figure 5.6: proposed stream form section (Charles McDowell)

figure 5.7: existing stream form section (Charles McDowell)

improve

near-stream improvements

vegetation zones

The vegetation zones are located in direct connection with Brush Creek and the available moisture in the area. Each zone serves a purpose in relation to the environmental health of Brush Creek. Mowed turf areas act as the edge to the urban environment, drawing people into the site and allowing for adaptable open space. The major turf space adjacent to Swope Parkway is lined with a bioswale, collecting water from the Parkway and adjacent land, filtering it and moving it to the constructed wetland or to Brush Creek. The rain garden collects water from the parking lot and filters and infiltrates the water. If the rain garden reaches capacity, the water flows into the bioswale and then to the constructed wetland.

The constructed wetland acts as infiltration and filtration device for the water that flows into it. These processes are exposed to the users of the site as the constructed wetland is lined with a major pedestrian walkway. The upland slopes line the landforms which flow through the site. The upland transitional vegetation forms a transition from the upland slopes, wetlands, and turf to wetland vegetation. The lowland vegetation is currently located in an areas that has low percentage slopes and is in an area that has high moisture. Water is collected off of the highway bridges in the lowland area. The natural wetland is located in the Brush Creek Channel and contains vegetation that is constantly inundated during rain events.

legend

mowed turf

upland slopes

upland transitional

lowland

constructed wetland

natural wetland

rain garden

bioswale

brush creek

figure 5.8: vegetation zones diagram (Charles McDowell)

legend

brush creek -low flow channel

first area flooded

second area flooded

third area flooded

fourth area flooded

area of inundation

The changes in earthwork on the site have created landforms that are elevated above the flooded area. Some of the existing flooded areas were excavated and the fill was used to elevate the landforms. This process expands the floodplain and allows for greater inundation in the flooded area. The proposal creates more space for flood flows to expand onto the site in order to reduce flood pressures on upstream and downstream areas. The crossing pathways are elevated on the landforms so that they can still be used during flood events.

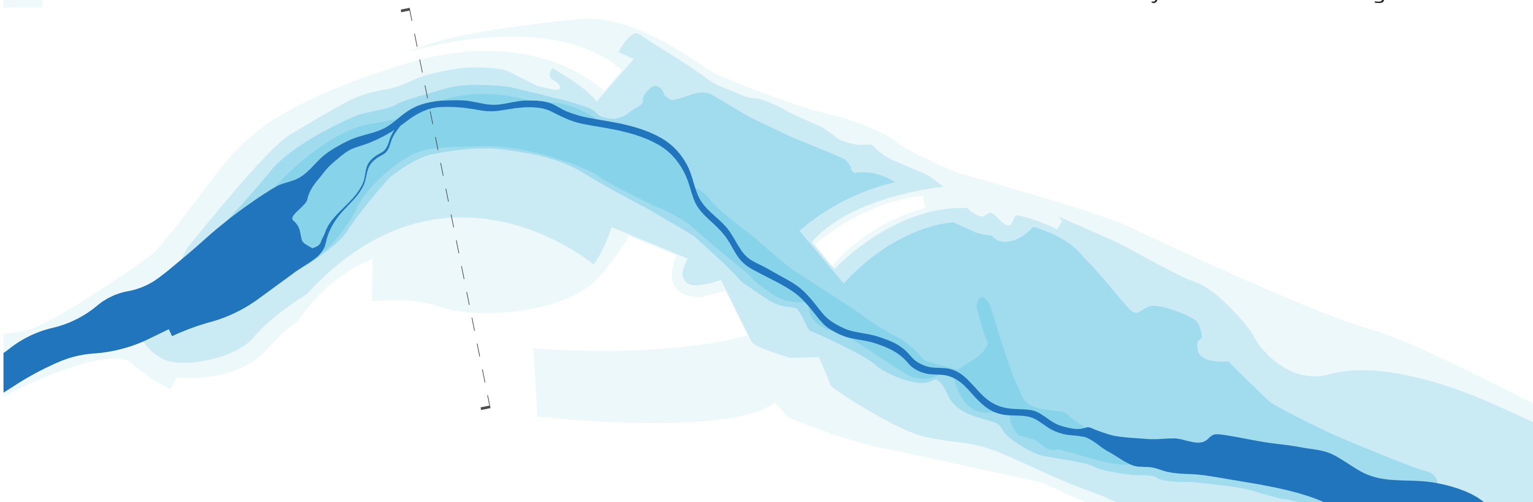


figure 5.9: area of inundation diagram (Charles McDowell)

nts N

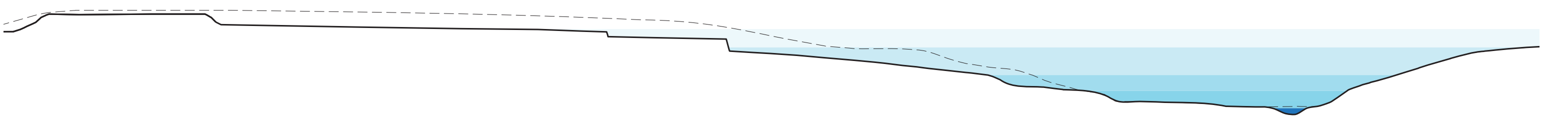


figure 5.10: area of inundation section (Charles McDowell)

connect

adjacent connections

corridor connections

One of the major objectives of the project was to create connections throughout the corridor. This involves linking the individual projects within the corridor to one another. In its existing condition, the site has no through walkways. The proposal connects to the walkways that dead end on both sides of Brush Creek along the west side of the site. These walkways connect through the site to the walkway on the north side of Brush Creek on the east side of the site. With the completion of the project in the Troost Reach, which is currently under construction, this project will connect in with the trail system that extends from the plaza to the way to the Lake of the Enshriners.

neighborhood connections

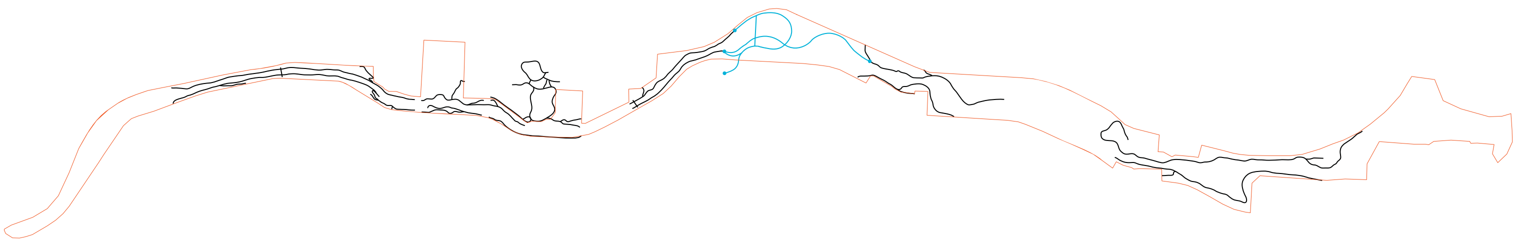
The design proposal aims at improving neighborhood connections across Brush Creek and through the corridor. As the site exists prior to design, pedestrians who are moving across Brush Creek from the surrounding neighborhoods have to cross at either the Paseo Bridge or the Prospect Avenue Bridge. The proposed design allows for pedestrians moving across the stream to cross the corridor along pedestrian walkways and bridges as opposed to highly used vehicular bridges. The proposal also allows for through corridor passage along the stream corridor instead of along busy roads under the Highway 71 bridges.

legend

proposed walkway

existing walkway

corridor study boundary



N nts

figure 5.11: corridor connections diagram (Charles McDowell)

figure 5.12: neighborhood connections diagram (Charles McDowell)

connect

site connections

circulation

The proposal aims to connect the site across Brush Creek and through the corridor. Three bridges cross Brush Creek allowing for improved cross corridor connection. A bridge crosses Swope Parkway connecting the site to the Paseo Academy of the Performing Arts. The pedestrian walkways on site link into the existing trail network to the east and the west of the site. The through and cross connections are elevated so that they are not flooded under high flow conditions.

legend

- pedestrian circulation
- vehicular circulation
- brush creek

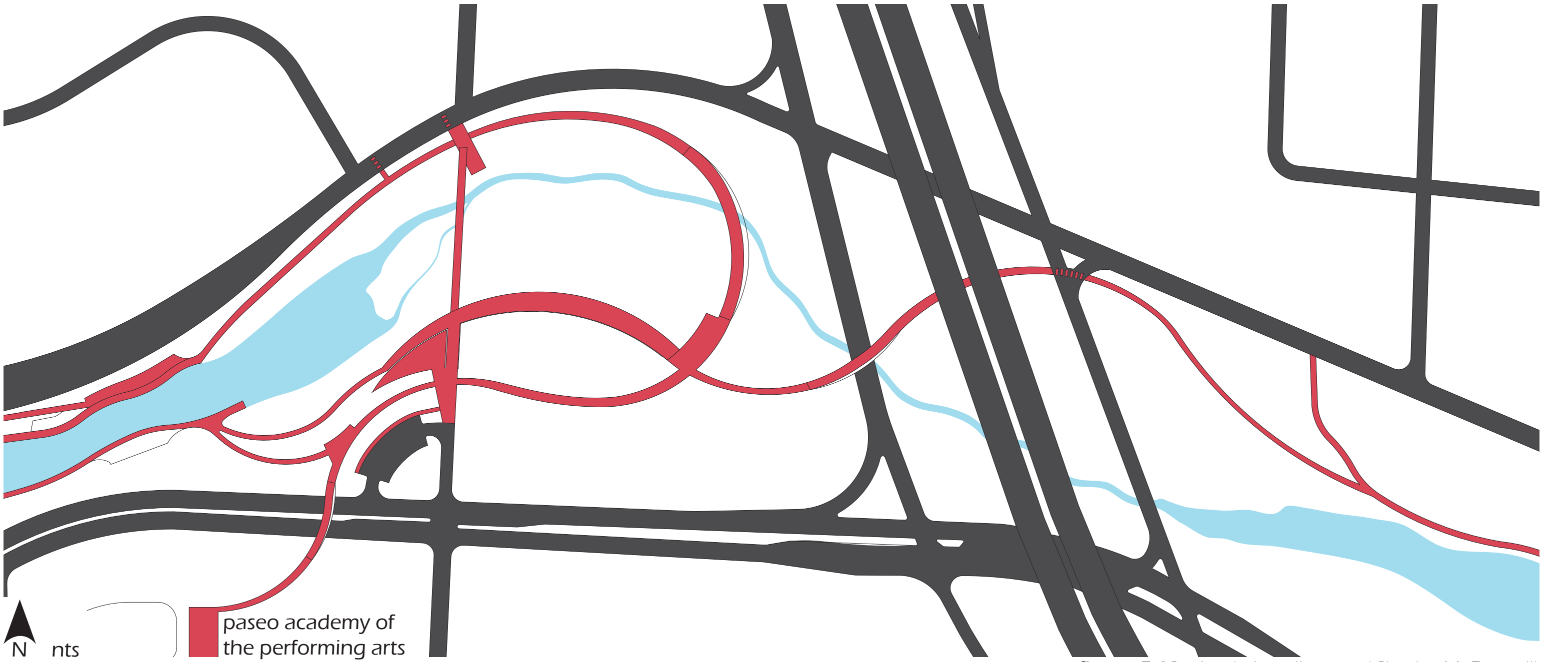


figure 5.13: circulation diagram (Charles McDowell)

legend

1	rain garden
2	bioswale
3	walkway along constructed wetland
4	bridge looking over wetlands
5	bridge over existing and adjusted stream alignment
6	walkway overlooking lowlands
7	outlook from Paseo Academy of the Performing Arts
8	outlook over existing & proposed alignment
9	outlook over constructed wetland and natural wetland
10	outlook over Brush Creek, wetlands, and upland

connections to stream ecology

Because of the location and elevation of the pedestrian oriented spaces, the users are better exposed to the ecological process of the Brush Creek Corridor and the proposed improvements. A number of key locations along the walkways are elevated above Brush Creek presenting the opportunity for views that reveal the ecology of Brush Creek to the users. Other elements such as the bioswale and rain garden are highly visible to users of the site.

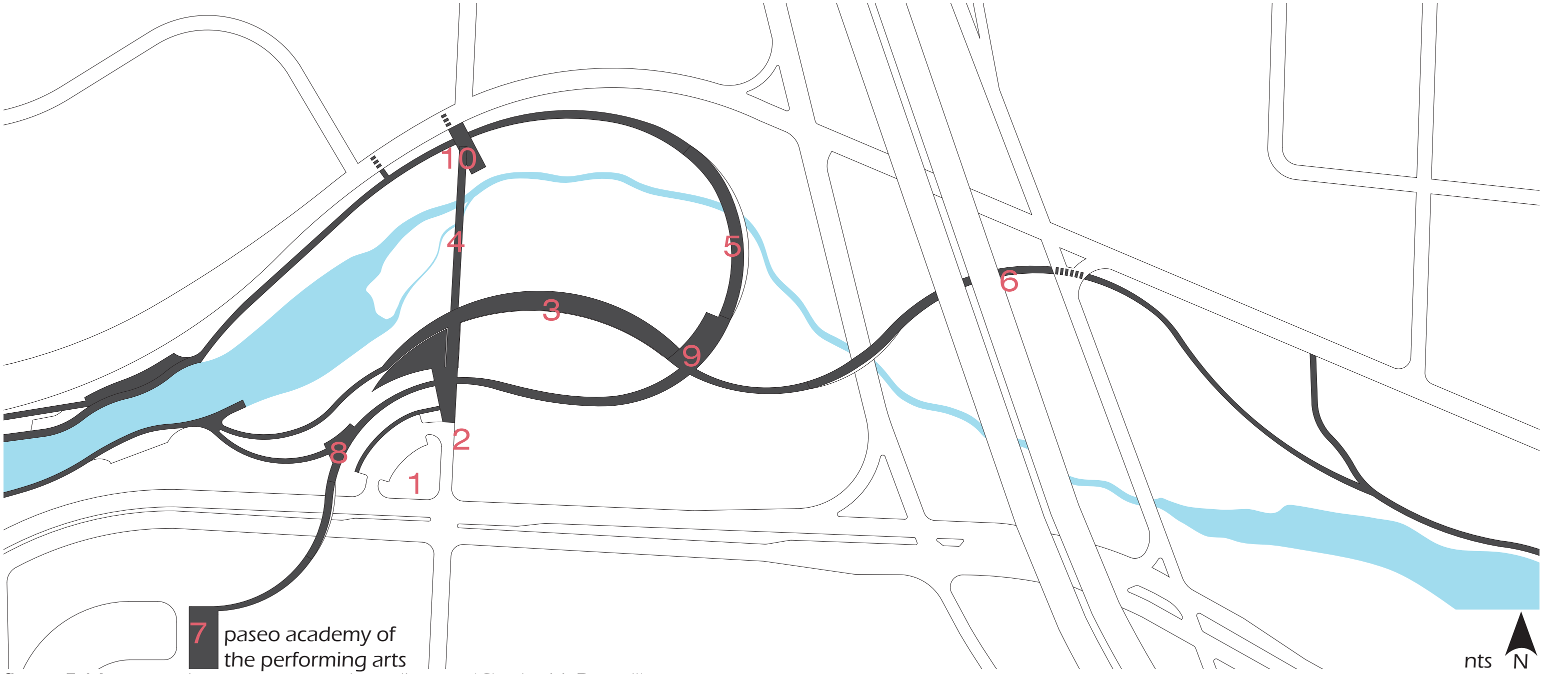


figure 5.14: connections to stream ecology diagram (Charles McDowell)

educate

In order to educate the users of the Brush Creek Corridor and the project to the environmental benefits of ecological design, two themes were chosen to represent the urban stream ecology: water and vegetation.

water

Water is the fundamental element that makes Brush Creek flow. The importance of water and how we handle water, especially in urban contexts, is the primary message that is conveyed to the users of the site. The elevated walkways and viewing areas allow for views to Brush Creek and the processes occurring in and near the stream. Interpretive signage will be placed at these locations describing processes, form, and function of the subject.

Some of the educational messages include:
flood potential and flooded area
stream form
stormwater runoff
constructed wetland

The images to the right depict the before and after scene of the Brush Creek. The improvements include the removal of the step and the implementation of wetland vegetation. The bridge crossing Brush Creek allows users to compare current stream management practices upstream, to the site improvements. Since users are not restricted to formal walkways, they are able to explore the stream ecology. Community organizations and schools have the opportunity to use the site for classes such as fly-fishing or any other activities usually limited because of their urban confines.

figure 5.15: water perspective - existing (Charles McDowell)

figure 5.16: water perspective - proposed (Charles McDowell)

educate

water

In order to educate users to the processes that influence Brush Creek, users have multiple vantage points where viewing is possible. Multiple bridges, lookout points, and walkways provide optimal locations for signage and interactive interpretation which relate to the processes of water.

legend

1	area overlooking existing stream form
2	bridge overlooking existing and proposed alignment
3	area overlooking proposed alignment
4	plaza adjacent to constructed wetland
5	bridge overlooking stream conditions under the highway

figure 5.17: educate - water diagram (Charles McDowell)

interaction

Users are encouraged to experience the landscape and the processes at work on site. Hands on interaction is important in furthering education. Users are able to leave formal paths to interact at a more personal level with the landscape, using all senses to learn about the ecology of Brush Creek.

To the right is an image which demonstrates the technology, and interpretive signage which could be used in order to educate users of the processes related to water on the site. This image depicts an interactive sign being used to learn about stormwater runoff. The user acts as if their finger is a raindrop and wherever the finger is placed on the map is where the flow starts. From there the raindrop flows down the path where water would flow on site. This example shows direct runoff down a drainage gutter, flow and infiltration in the bioswale, filtration and infiltration in the constructed wetland, overland flow to Brush Creek, and steam flow within Brush Creek.

Other signage which can convey similar messages but for different processes is possible throughout the site. Interactive signage showing historical stream flow, and stream development, flood potential, stream form, and other process are strategically placed throughout the site where the users can see direct relationships between the educational message and the function of Brush Creek.

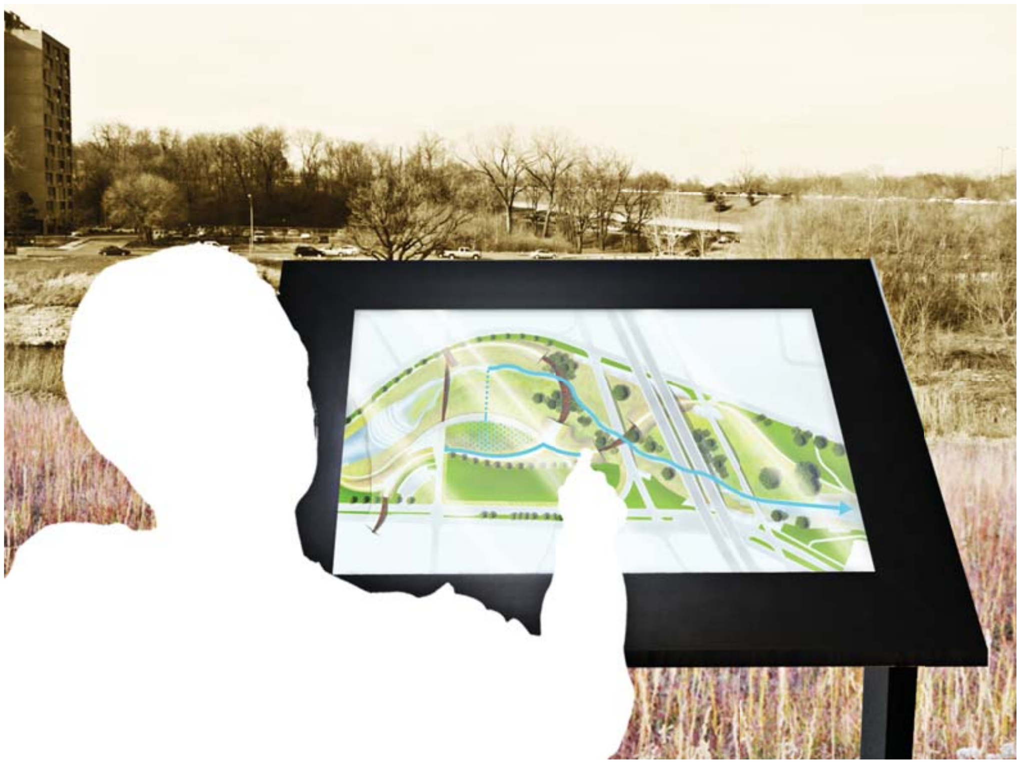


figure 5.18: interactive signage perspective (Charles McDowell)

vegetation

The environmental conditions in the Brush Creek Corridor create a direct associate between water and vegetation. The functionality of vegetation is primarily related to the moisture conditions of the location and therefore has a direct impact on Brush Creek. Walkways and viewing areas are strategically located along, through, and over different areas of vegetation throughout the site. Interpretive signage will be placed at these locations describing processes, form, and function of the subject.

Some of the educational messages include:
rain garden
bioswale
wetlands
uplands

The images to the right depict the before and after scene of the lowland area east of Highway 71. The area is revitalized from mowed turf to lowland vegetation in order to reduce overland runoff and improve water infiltration. The walkway slopes up to the intersection of Emanuel Cleaver II Boulevard and the highway access road. Along the walkway are vegetated upland slopes.


figure 5.19: vegetation perspective - existing (Charles McDowell)

figure 5.20: vegetation perspective - proposed (Charles McDowell)

vegetation

In order to educate users to the processes that influence Brush Creek, users have multiple vantage points where viewing is possible. Multiple bridges, lookout points, and walkways provide optimal locations for signage and interactive interpretation which relate the users to the site vegetation.

1	area overlooking rain garden
2	green space adjacent to bioswale
3	area overlooking wetlands
4	plaza adjacent to constructed wetland
5	area overlooking constructed wetlands, upland transition, and wetlands
6	walkway overlooking lowlands

figure 5.21: educate - vegetation diagram (Charles McDowell)

interaction

Users of the site are exposed to a variety of vegetation areas related to walkways and viewing areas. Lookout points offer users the opportunity to view the processes related to vegetation and relate them to educational signage. Walkways are placed next to a variety of areas to encourage interaction. One unique feature exposes users to the processes of the constructed wetland by placing a highly durable and scratch-resistant glass-like wall along the side of the constructed wetland. Users can see the interaction of water, vegetation, and soil through this feature. Residents and community members in the Kansas City area will be invited to take on the roles of stewards and natural area management specialists to work with volunteers as they work to maintain the naturalized ecosystems.

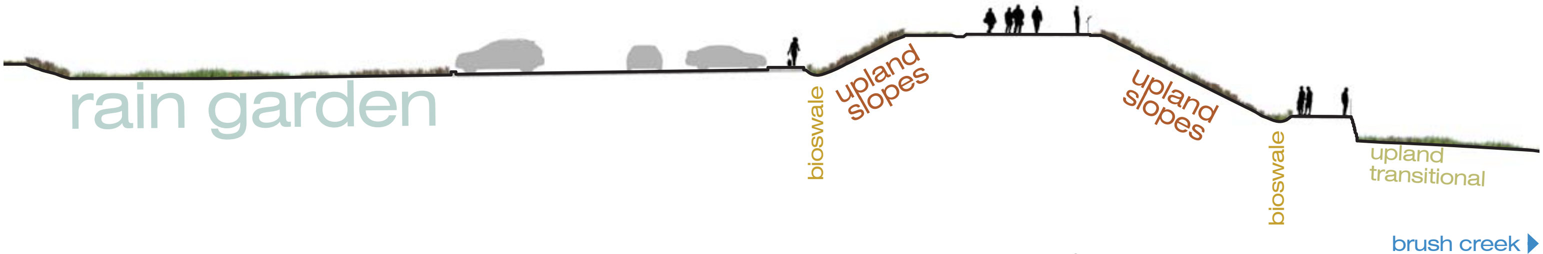


figure 5.22: vegetation section 1 (Charles McDowell)

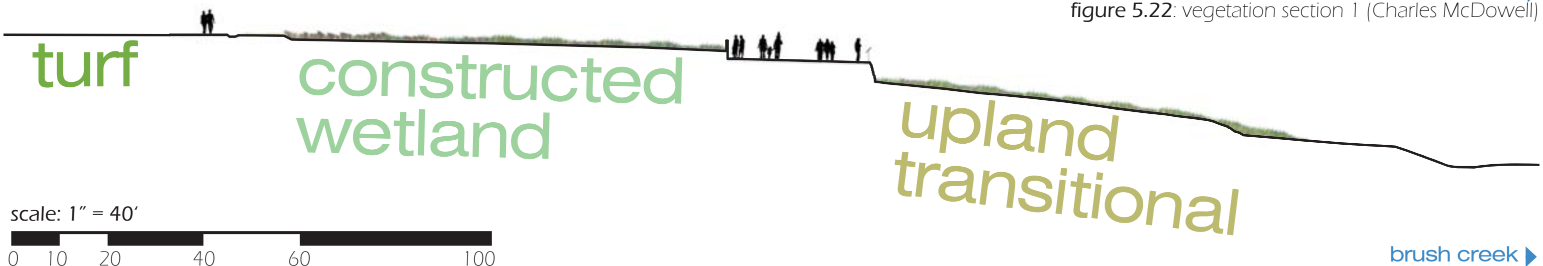


figure 5.23: vegetation section 2 (Charles McDowell)

material estimates

earthwork estimations

area	cut	fill	net
A	53,662 Cu. Yd.	36,888 Cu. Yd.	16,774 Cu. Yd. Cut
B	1,391 Cu. Yd.	1,415 Cu. Yd.	24 Cu. Yd. Fill
C	55 Cu. Yd.	6,517 Cu. Yd.	6,462 Cu. Yd. Fill
D	0 Cu. Yd.	18,041 Cu. Yd.	18,041 Cu. Yd. Fill
E	0 Cu. Yd.	1,214 Cu. Yd.	1,214 Cu. Yd. Fill
Net	**55,108 Cu. Yd.**	**64,075 Cu. Yd.**	**8,967 Cu. Yd. Fill**

materials	length	area
Concrete Walks	4052 ft.	48,629 sq. ft.
Hadscape Plazas		45,114 sq. ft.
Parking and Drive		16,306 sq. ft.
Bridge 1a	167 ft.	
Bridge 1b	347 ft.	
Bridge 1c	396 ft.	
Bridge 1d	220 ft.	

vegetation	area
Mowed Turf	150,636 sq. ft.
Upland Slopes	100,788 sq. ft.
Upland Transitional	109,289 sq. ft.
Lowland	224,091 sq. ft.
Constructed Wetland	46,063 sq. ft.
Natural Wetland	98,296 sq. ft.

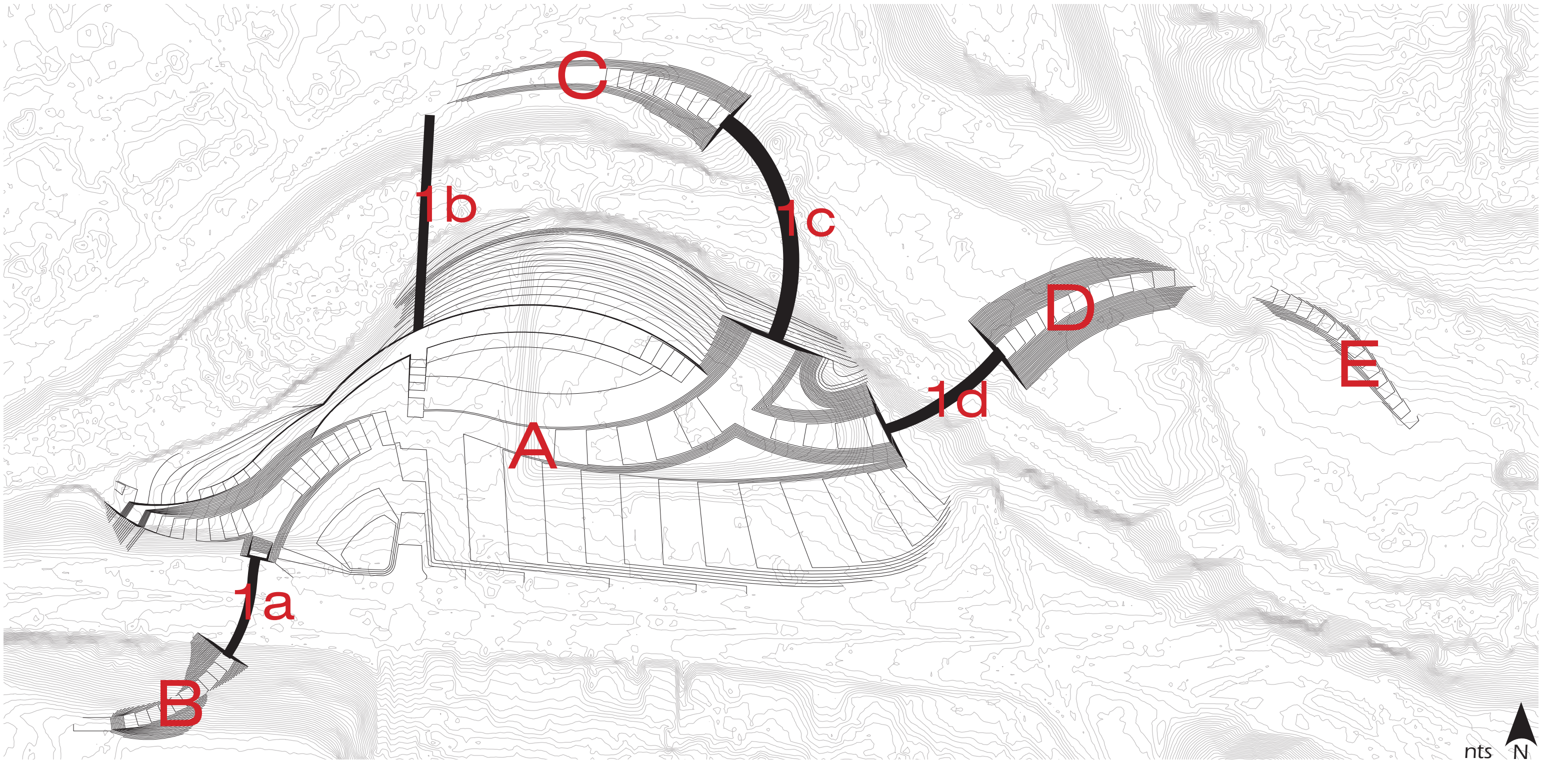


figure 5.24: materials diagram (Charles McDowell)

phasing

corridor project phasing

The proposed project to be developed at the Woodland/ Bruce R. Watkins site would occur in conjunction with the construction of the other two projects proposed for the sites identified in the corridor analysis. West Plaza and the Confluence with Blue River sites would also be developed based on a long term phasing strategy.

Because the proposed project at the Woodland/ Bruce R. Watkins site requires soil to be brought in for excess fill, it will be the last project completed in the phasing of the three sites. The projects at the West Plaza and the Confluence with the Blue River sites will expand the floodplain in order to help improve environmental conditions. This will create excess cut which can then be transferred to the Woodland/ Bruce R. Watkins site to create its landforms.

Phase 1 - West Plaza

Phase 2 - Confluence with the Blue River

Phase 3 - Woodland/ Bruce R. Watkins

site phasing

Phase 1 - Complete area **A** to open area as a stand alone park and a trail head.

Phase 2 - Complete areas **D** and **E** and construct bridge **1d** to open the corridor to through corridor connections. Construct bridge **1b** to open the site to cross-stream connections.

Phase 3 - Complete areas **C** and **B** and construct bridges **1a** and **1c** to complete cross-stream connections to the high school and middle school.

Phase 4 - Form and establish wetland vegetation in, and near-stream after all construction is completed.

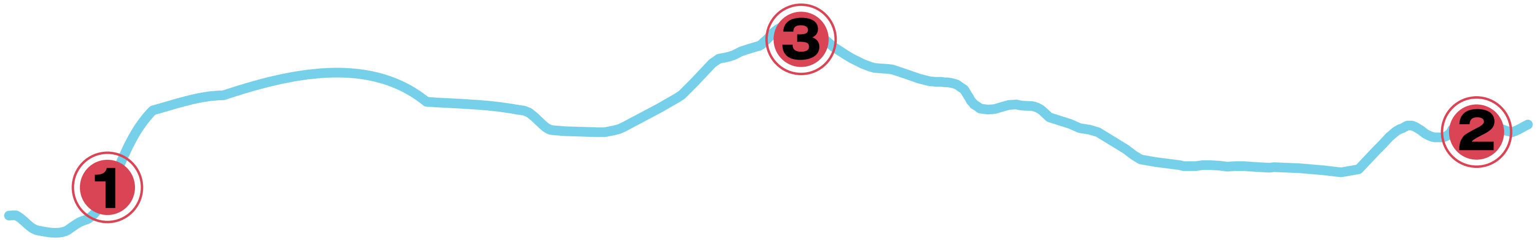


figure 5.25: corridor project phasing diagram (Charles McDowell)

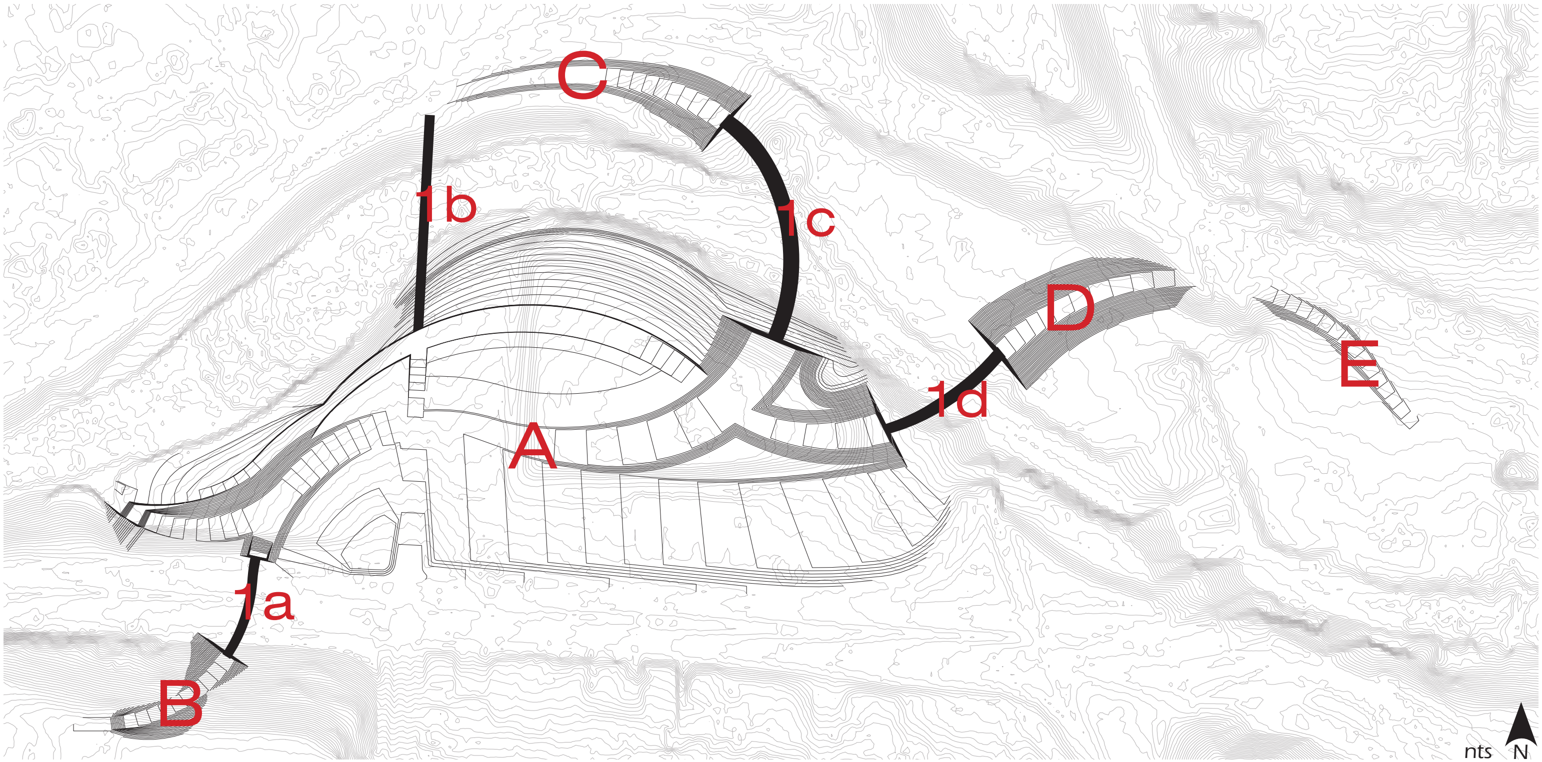


figure 5.26: site phasing diagram (Charles McDowell)

figure 5.27: *alternative two master plan (Charles McDowell)*

alternative two

legend

1	parking area
2	rain garden
3	bioswale
4	open green space
5	vegetated filter strip
6	plaza
7	constructed wetland
8	elevated outlook area
9	pedestrian bridge
10	wetlands
11	stormwater collection area off of bridge
12	lowland area

scale: 1″ = 200′

0 50 100 200 300 500

improve

in-stream improvements

stream alignment

The alignment of Brush Creek is the location of the stream flow line. As Brush Creek currently flows, there is a drop in stream surface elevation of about a half a foot where the flood control project ends and the natural stream alignment begins. The proposed alignment will remove this drop to allow for a more natural meander further upstream. The concrete lined channel beneath the highway bridges is removed and the channel is able to move laterally within the confines of the structural columns of the highway.

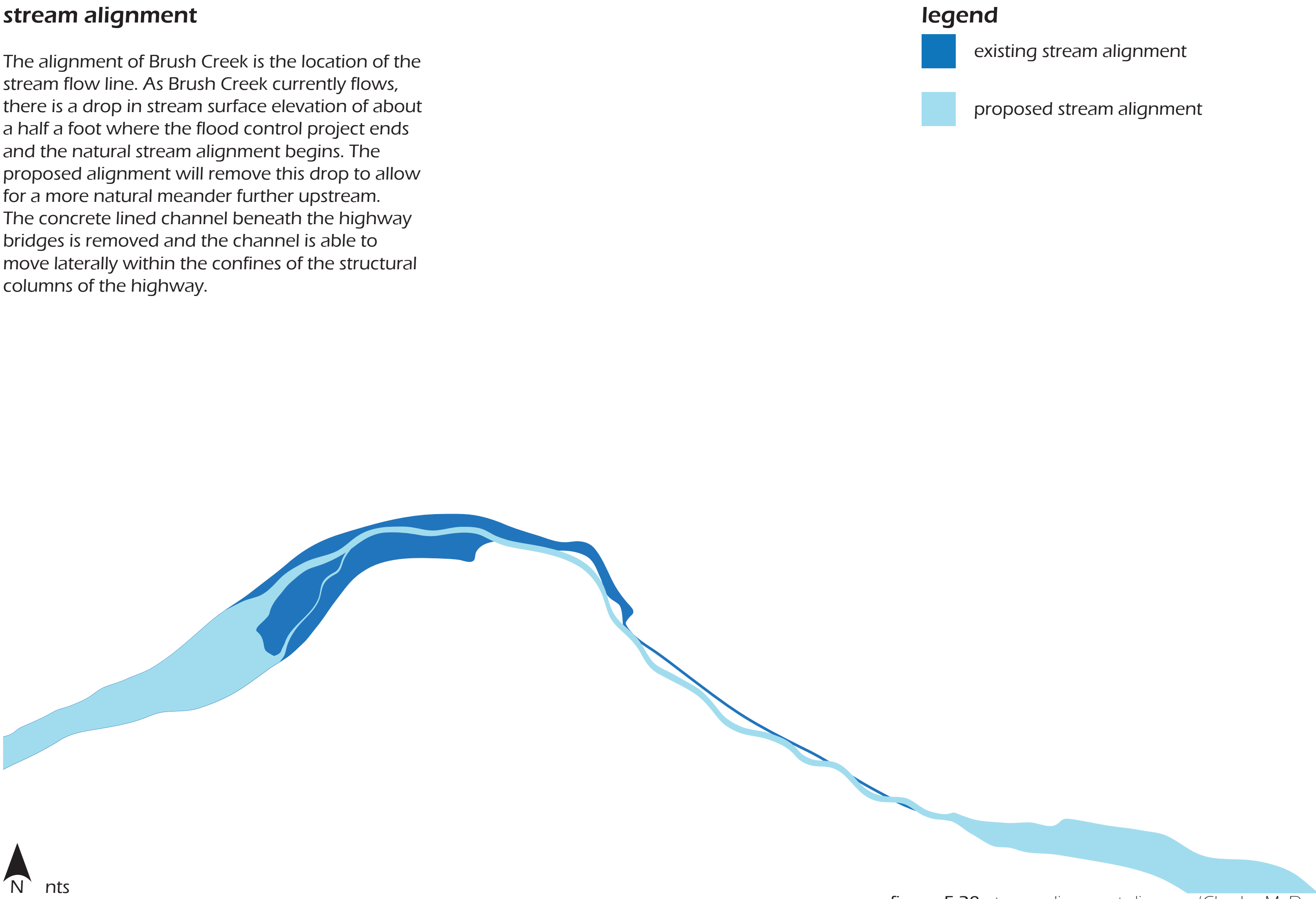


figure 5.28: stream alignment diagram (Charles McDowell)

stream form

The current condition of the form of Brush Creek ranges from channelized to control flooding, concrete lined, and naturalized. The proposed changes allow for Brush Creek to take a more natural form and to migrate and adjust to changes in flows over time. The proposal removes all concrete linings and restores Brush Creek to a natural form allowing for wetland bars and riparian vegetation to fill in along the stream. This proposal will allow for more infiltration, and filtration of the water as well as produce shelter and habitat where currently it is lacking.

figure 5.29: proposed stream form section (Charles McDowell)

scale: 1″ = 20′

0 5 10 20 30 50

figure 5.30: existing stream form section (Charles McDowell)

improve

near-stream improvements

vegetation zones

The vegetation zones are located in direct connection with Brush Creek and the available moisture in the area. Each zone serves a purpose in relation to the environmental health of Brush Creek. Mowed turf areas act as the edge to the urban environment, drawing people into the site and allowing for adaptable open space. Swope Parkway is lined with a bioswale, collecting water from the Parkway and adjacent land, filtering it and moving it to the constructed wetland or to Brush Creek. The rain garden collects water from the parking lot and filters and infiltrates the water. If the rain garden reaches capacity, the water flows into the bioswale and then to the constructed wetland. These processes are exposed to the users of the site as the constructed wetland is lined with a pedestrian walkway. Upland vegetation exists on the top of the mound where there is low moisture. The upland slopes line the landforms which flow through the site. The upland transitional vegetation is a transition from the upland slopes, wetlands, and turf to wetland vegetation. The lowland vegetation is currently located in an areas that has low percentage slopes and is in an area that has high moisture. Water is collected off of the highway bridges in the lowland area. The natural wetland is located in the Brush Creek Channel and contains vegetation that is constantly inundated during rain events.

legend

mowed turf

upland

upland slopes

upland transitional

lowland

constructed wetland

natural wetland

rain garden

bioswale

brush creek

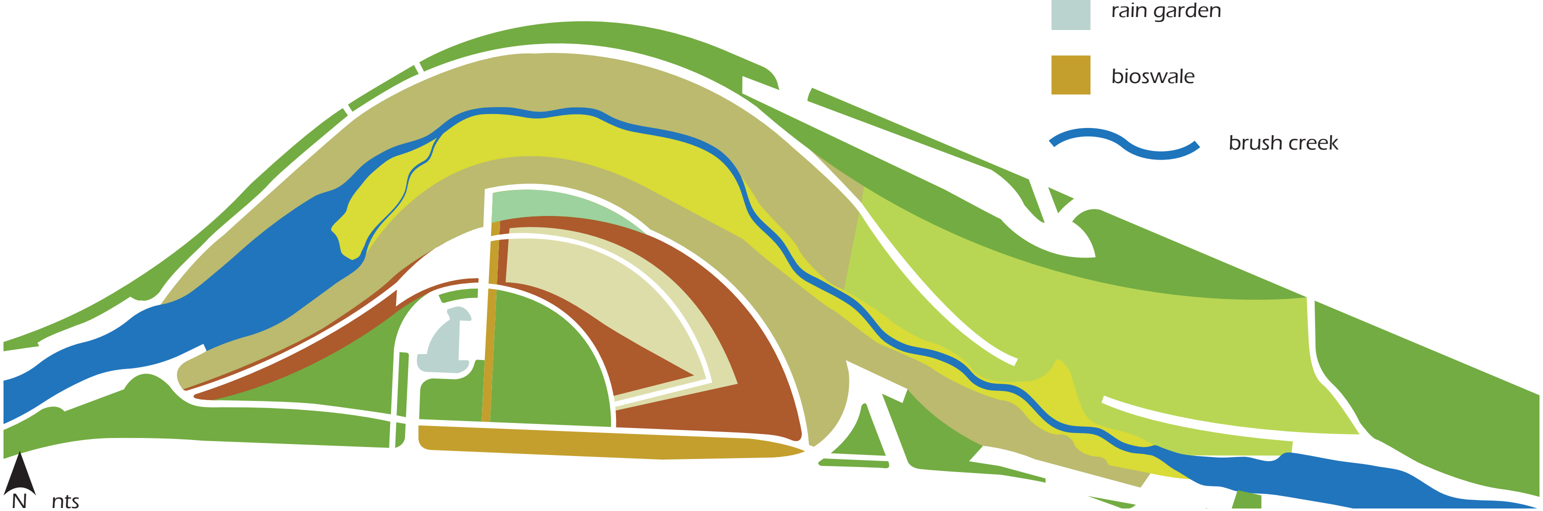


figure 5.31: vegetation zones diagram (Charles McDowell)

legend

brush creek -low flow channel

first area flooded

second area flooded

third area flooded

fourth area flooded

area of inundation

The changes in earthwork on the site have manipulated the existing landform so as to create a more usable adaptive green space. The manipulation of the landform does not significantly change the floodplain or the area of flood inundation. The area nearest stream remains at the same elevation as prior to site development. Since it is elevated above the existing elevation, the proposed landform will be the last area on site to flood.

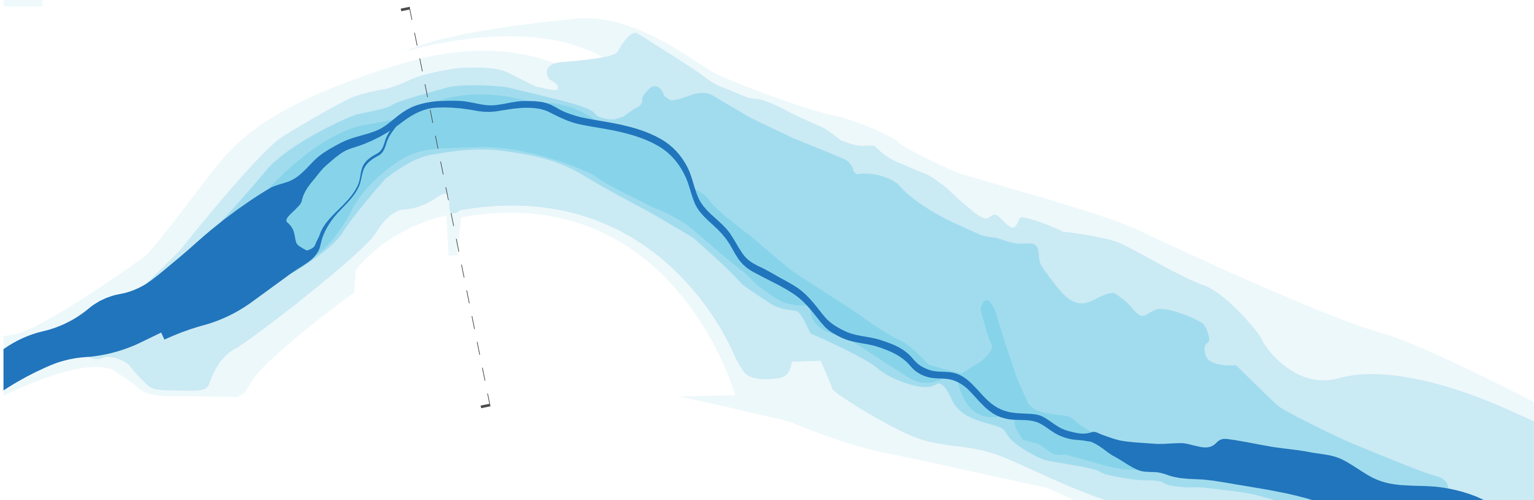


figure 5.32: area of inundation diagram (Charles McDowell)

nts N

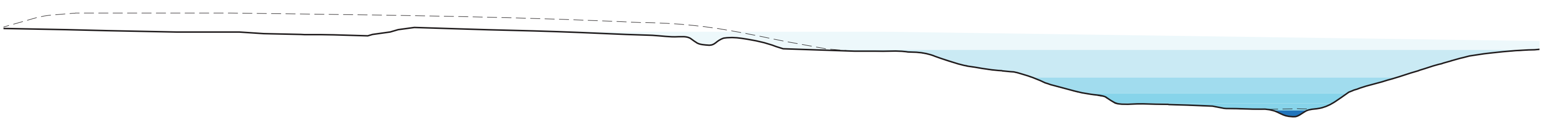


figure 5.33: area of inundation section (Charles McDowell)

connect

corridor connections

One of the major objectives of the project was to create connections throughout the corridor. This involved linking the individual projects within the corridor to one another. In its existing condition, the site has no through walkways. The proposal connects the walkways that dead end on both sides of Brush Creek along the west side of the site. These walkways connect throughout the site to the walkways on both sides of Brush Creek on the east side of the site. With the completion of the Troost Reach project, currently under construction, this project will provide linkage with the trail system extending from the Plaza to the Lake of the Enshriners.

neighborhood connections

The design proposal aims at improving neighborhood connections across Brush Creek and through the corridor. As the site exists prior to design, pedestrians who are moving across Brush Creek from the surrounding neighborhoods have to cross at either the Paseo Bridge or the Prospect Avenue Bridge. The proposed design allows for pedestrians moving across the stream to cross the corridor along pedestrian walkways and bridges as opposed to highly used vehicular bridges. The proposal also allows for through corridor passage along the stream corridor instead of along busy roads under the Highway 71 bridges.

legend

proposed walkway

existing walkway

corridor study boundary

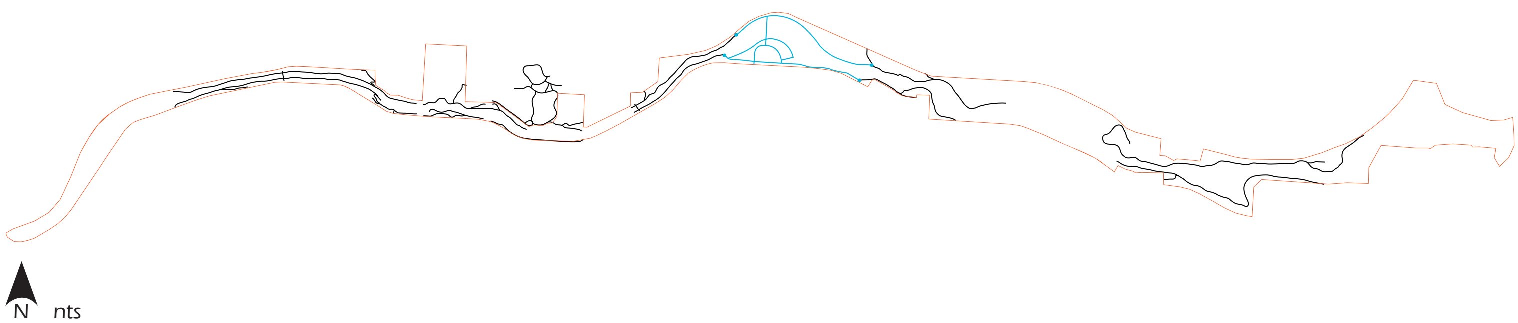


figure 5.34: corridor connections diagram (Charles McDowell)

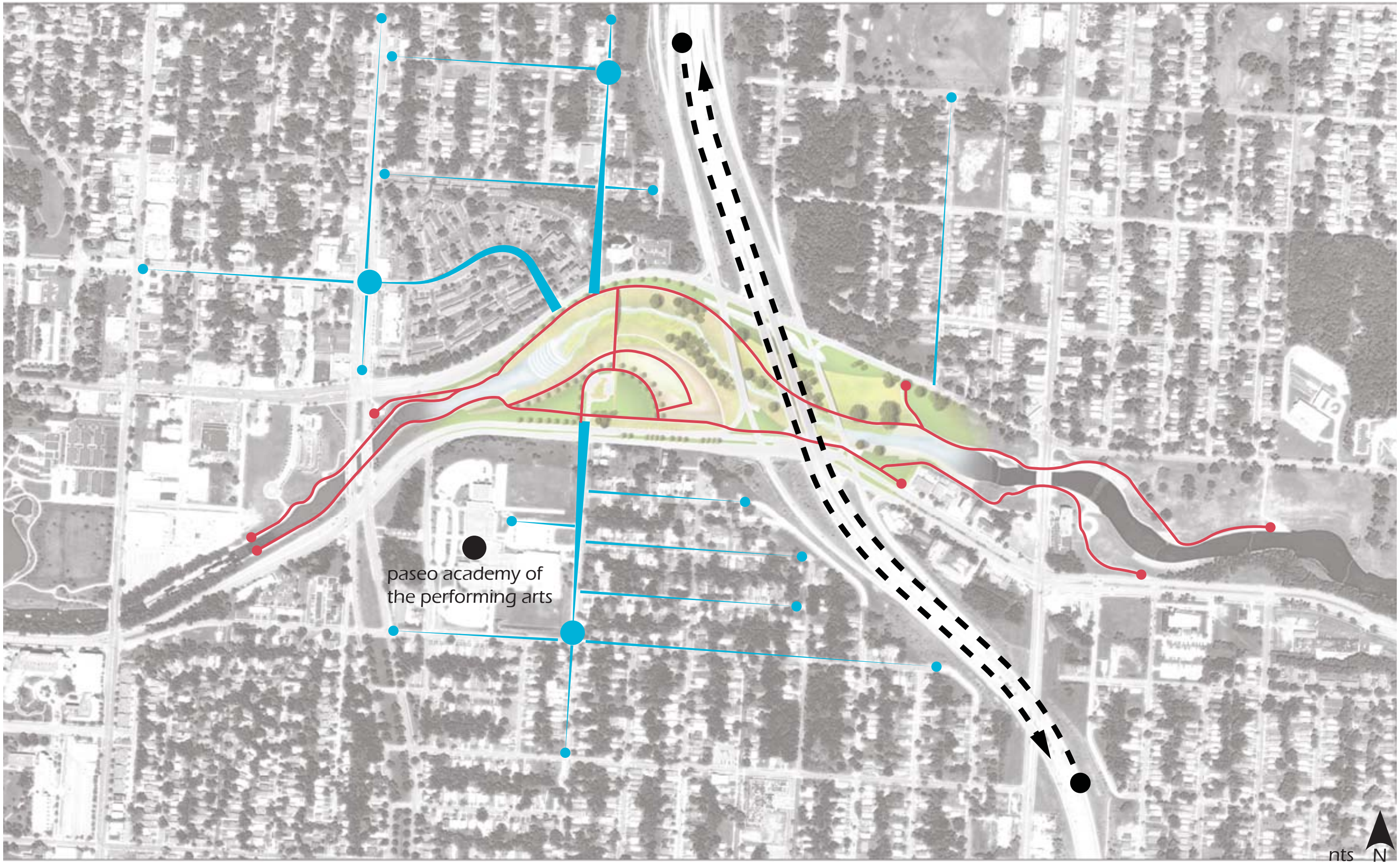


figure 5.35: neighborhood connections diagram (Charles McDowell)

connect

site connections

circulation

The proposal aims to connect the site across Brush Creek and through the corridor. One bridge crosses Brush Creek allowing for improved cross corridor connection. The pedestrian walkways on site link into the existing trail network to the east and west of the site. The walkways connect the corridor on both the north and the south side of the site enabling users to stay on either side of Brush Creek.

legend

pedestrian circulation

vehicular circulation

brush creek

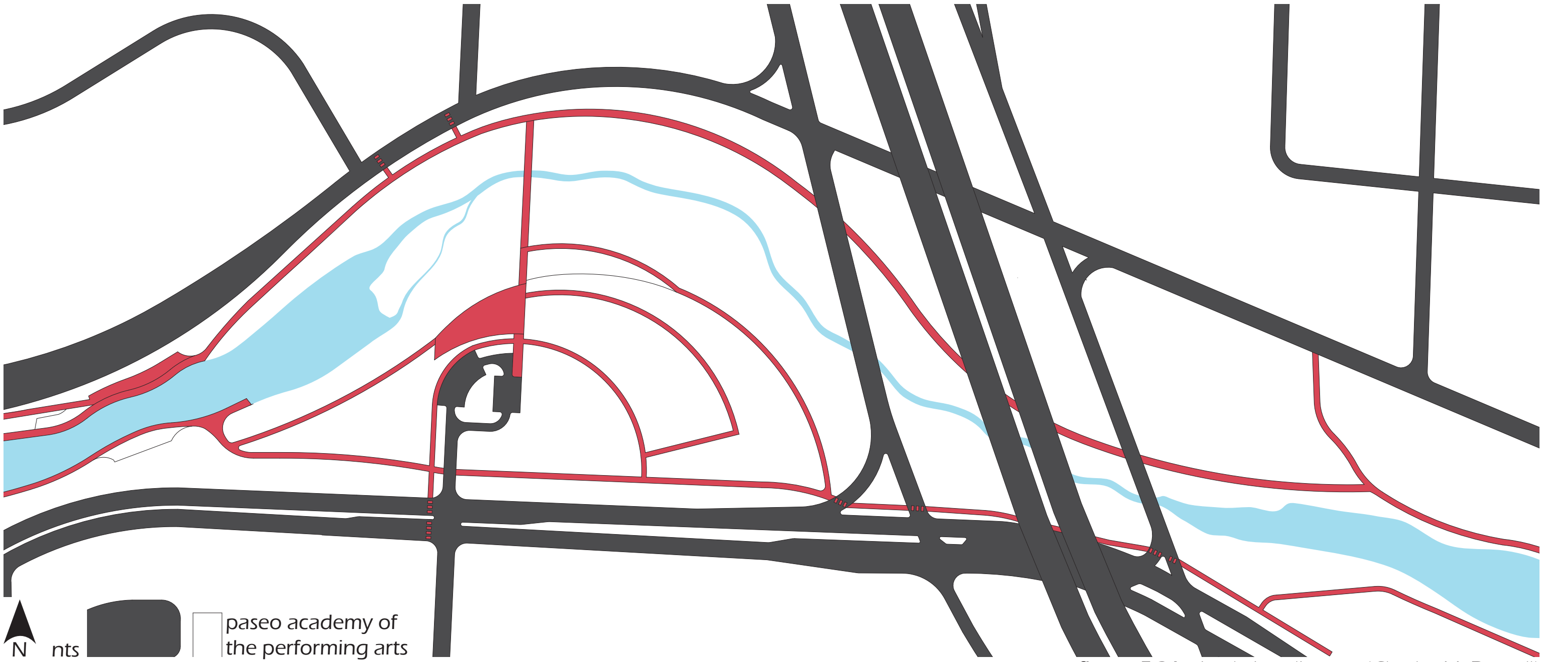


figure 5.36: circulation diagram (Charles McDowell)

legend

1 rain garden
2 bioswale
3 walkway along constructed wetland
4 walkway overlooking stormwater collection off of highway
5 bridge over drainage area
6 plaza overlooking existing and adjusted stream alignment
7 bridge overlooking Brush Creek and wetlands
8 outlook over wetlands and Brush Creek

connections to stream ecology

The location of the pedestrian oriented spaces allows the users to be exposed to the ecological process of the Brush Creek Corridor and the proposed improvements. A number of key locations along the walkways are strategically located, revealing the ecology of the site to the users. Other elements, such as the bioswale and rain garden, are also highly visible to users of the site.

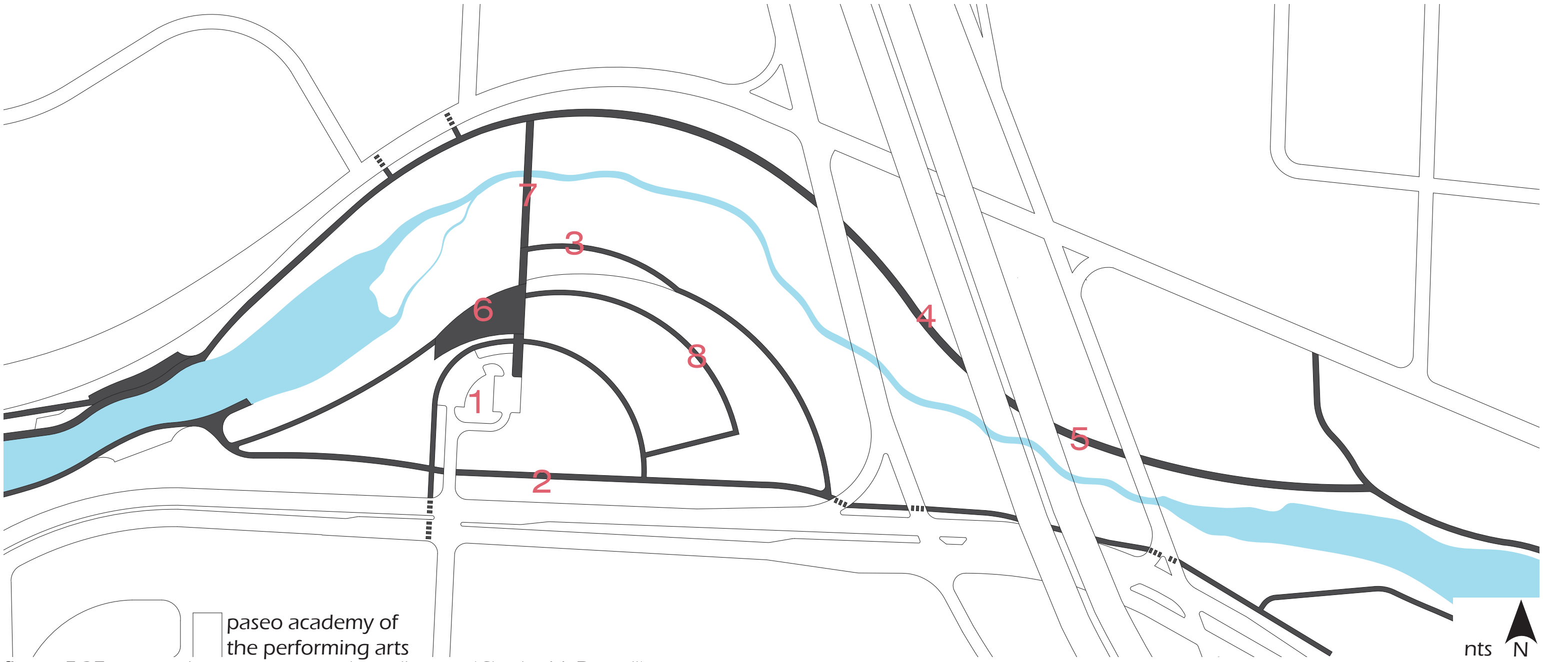


figure 5.37: connections to stream ecology diagram (Charles McDowell)

educate

In order to educate the users of the Brush Creek Corridor and the project to the environmental benefits of ecological design, two themes were chosen to represent the urban stream ecology: water and vegetation.

water

Water is the fundamental element that makes Brush Creek flow. The importance of water and how we handle water, especially in urban contexts, is the primary message that is conveyed to the users of the site. The walkways and viewing areas allow for views to Brush Creek and the processes occurring in and near the stream. Interpretive signage will be placed at these locations describing processes, form, and function of the subject.

Some of the educational messages include:
flood potential and flooded area
stream form
stormwater runoff
constructed wetland

The images to the right depict the before and after scene of Brush Creek under the highway overpass. The proposal removes the concrete channel, realigning Brush Creek to a more natural meander. Wetland vegetation lines the channel providing habitat and improving stream quality. Users are encouraged to leave the designated walkways to interact with the stream ecology. This allows for teachers to bring students to Brush Creek to learn about urban stream ecology.

figure 5.38: water perspective - existing (Charles McDowell)

figure 5.39: water perspective - proposed (Charles McDowell)

educate

water

In order to educate users to the processes that influence Brush Creek, users have multiple vantage points where viewing is possible. Multiple bridges, lookout points, and walkways provide optimal locations for signage and interactive interpretation relating to the processes of water.

1	*area overlooking existing stream form*
2	*bridge overlooking existing and proposed alignment*
3	*area overlooking proposed alignment*
4	*plaza adjacent to constructed wetland*
5	*bridge overlooking stream conditions under the highway*

figure 5.40: educate - water diagram (Charles McDowell)

interaction

Users are encouraged to experience the landscape and the processes at work on site. Hands-on interaction is important in furthering education. Users are able to leave formal paths to interact at a more personal level with the landscape, using all senses to learn about the ecology of Brush Creek.

To the right is an image that depicts the hands-on interpretive signage technology that could be used to educate users to the processes related to water on site. This example shows an interactive sign which the users learn about stormwater runoff. The users act as if their finger is a raindrop and wherever they place their finger on the map is where the flow starts. At this starting point on the interactive signage the raindrop flows down the path where water would flow on site. This example shows direct runoff down a drainage gutter, flow and infiltration in the bioswale, filtration and infiltration in the constructed wetland, overland flow to Brush Creek, and steam flow within Brush Creek.

Other signage which conveys the message in this way for other processes is possible throughout the site. Interactive signage showing historical stream flow and development, flood potential, stream form, and other process are strategically placed throughout the site where the users can see direct relationships between the educational message and the function of Brush Creek.

figure 5.41: interactive signage perspective (Charles McDowell)

educate

vegetation

Environmental conditions in the Brush Creek Corridor are a result of the direct relationship between water and vegetation. The functionality of vegetation is primarily related to the moisture conditions of the location and therefore has a direct impact on Brush Creek. Walkways are located along the edges of, cut directly through, or overlook different areas of vegetation throughout the site. Interpretive signage will be placed at these locations describing processes, form, and function of the subject.

Some of the educational messages include:
rain garden
bioswale
wetlands
uplands

The images to the right depict the before and after scene of the area under the highway overpass. The proposal addresses stormwater issues which occur from water draining from downspouts off of the bridges. Stones are placed beneath the spout in order to disperse and slow down water on the way to Brush Creek. Level spreaders spread water through the lowland and wetland vegetation. The close proximity of the walkway exposes users to these processes.

figure 5.42: vegetation perspective - existing (Charles McDowell)

figure 5.43: vegetation perspective - proposed (Charles McDowell)

vegetation

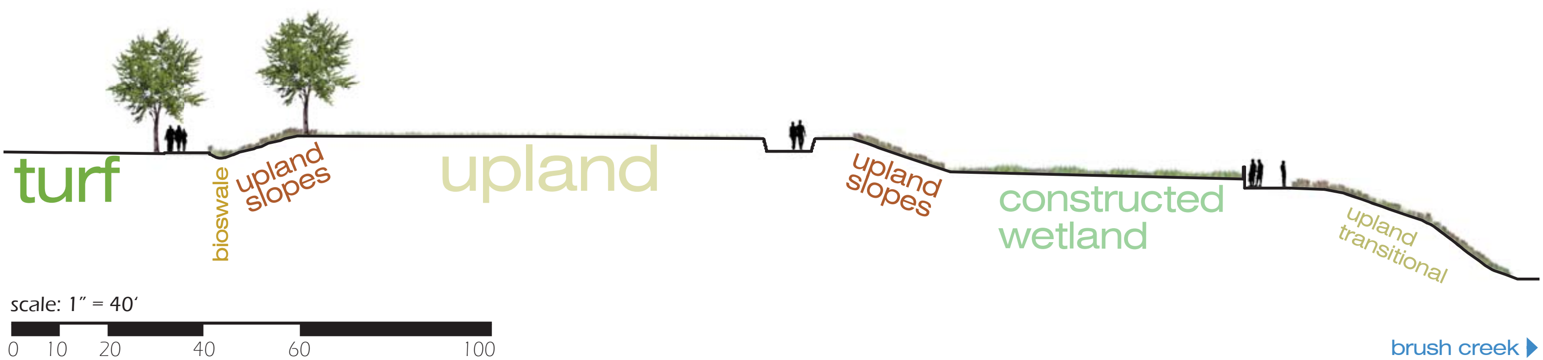
In order to educate users to the processes that influence Brush Creek, users have multiple vantage points where viewing is possible. Multiple bridges, lookouts, and walkways provide optimal locations for signage and interactive interpretation which would educate the users to the site vegetation.

1	parking area adjacent to rain garden
2	green space adjacent to bioswale
3	area overlooking wetlands
4	plaza adjacent to constructed wetland
5	area overlooking constructed wetlands, upland transition, and wetlands
6	walkway overlooking lowlands

figure 5.44: educate - vegetation diagram (Charles McDowell)

interaction

Users of the site are exposed to a variety of vegetation areas related to walkways and viewing areas. Lookout points offer users the opportunity to view the processes related to vegetation and relate them to educational signage. Walkways are placed next to a variety of areas to encourage interaction. One unique feature exposes users to the processes of the constructed wetland by placing a highly durable and scratch-resistant glass-like wall along the side of the constructed wetland. Users can see the interaction of water, vegetation, and soil through this feature. Residents and community members in the Kansas City area will be invited to take on the roles of stewards and natural area management specialists to work with volunteers as they work to maintain the naturalized ecosystems.



brush creek

figure 5.45: vegetation section (Charles McDowell)

material estimates

earthwork estimations

area	cut	fill	net
A	14,618 Cu. Yd.	14,514 Cu. Yd.	104 Cu. Yd. Cut
Net	**14,618 Cu. Yd.**	**14,514 Cu. Yd.**	**104 Cu. Yd. Cut**

materials	length	area
Concrete Walks	7,193 ft.	71,935 sq. ft.
Hadscape Plazas		13,929 sq. ft.
Parking and Drive		18,349 sq. ft.
Bridge 2a	260 ft.	
Bridge 2b	152 ft.	

vegetation	area
Mowed Turf	97,101 sq. ft.
Upland	142,064 sq. ft.
Upland Slopes	72,935 sq. ft.
Upland Transitional	80,659 sq. ft.
Lowland	239,569 sq. ft.
Constructed Wetland	12,211 sq. ft.
Natural Wetland	98,296 sq. ft.

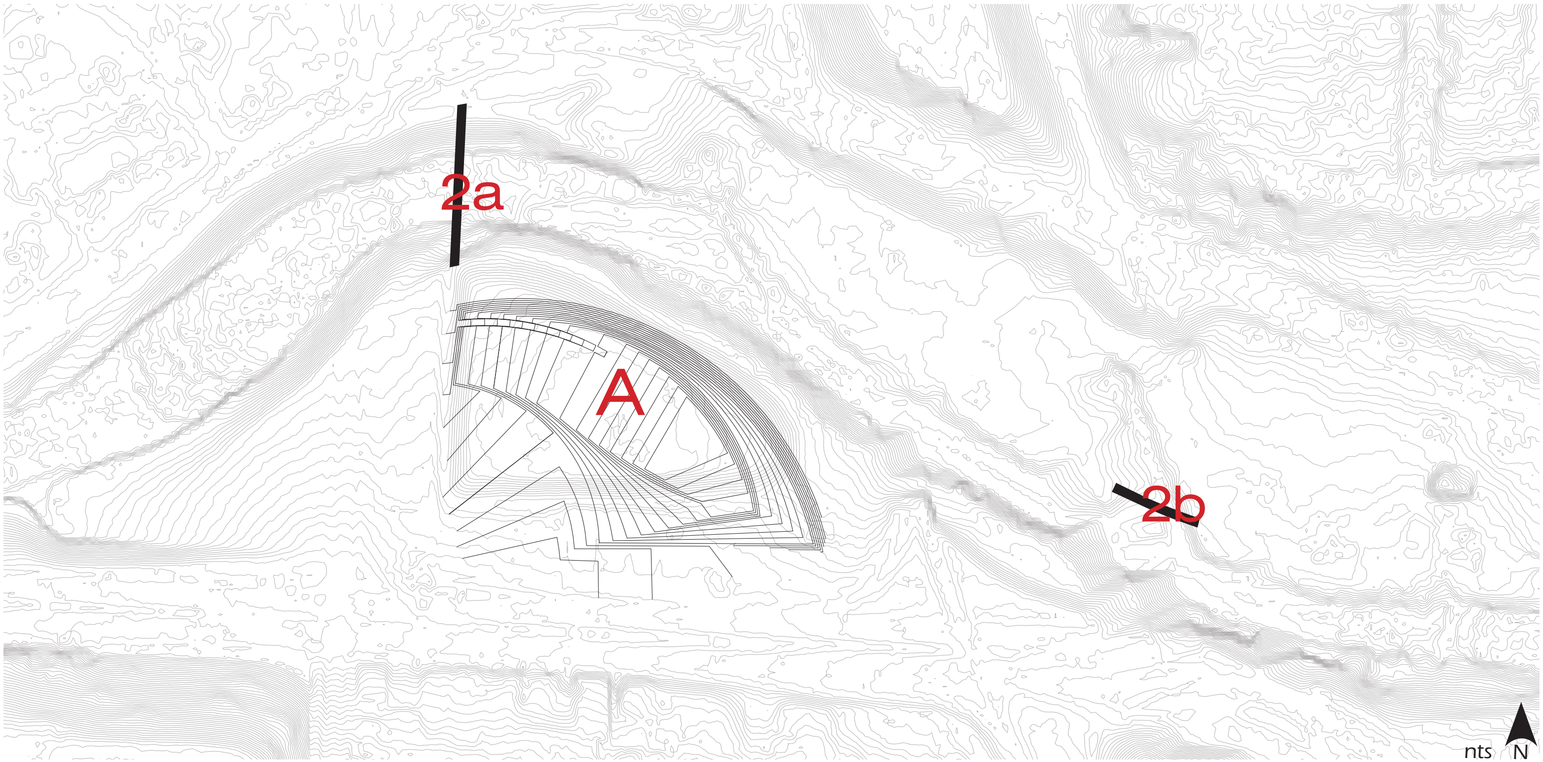


figure 5.46: materials diagram (Charles McDowell)

phasing

corridor project phasing

The proposed project to be developed at the Woodland/ Bruce R. Watkins site would occur in conjunction with the construction of the other two projects proposed for the sites identified in the corridor analysis. West Plaza and the Confluence with Blue River sites would also be developed based on a long term phasing strategy.

If necessary, the proposed project at the Woodland/ Bruce R. Watkins could stand alone without the implementation of other two projects if necessary. The project would be a catalyst for ecological design thinking in the Brush Creek Corridor and thus would be phase one in the long term development along the Brush Creek Corridor. The projects at the West Plaza and the Confluence with the Blue River sites would both be developed after the Woodland/ Bruce R. Watkins site. West Plaza would be developed second because of visibility, and the Confluence with the Blue River area last.

Phase 1 - Woodland/ Bruce R. Watkins

Phase 2 - West Plaza

Phase 3 - Confluence with the Blue River

site phasing

Phase 1 - Complete area **A** to open area as a stand alone park and a trail head.

Phase 2 - Construct bridge **2a** to open the site to cross-stream connections and to connect to the high school and middle school.

Phase 3 - Construct walkway and bridge **2b** and establish lowland vegetation to open the corridor to through corridor connections.

Phase 4 - Form and establish wetland vegetation in, and near-stream after all construction is completed.

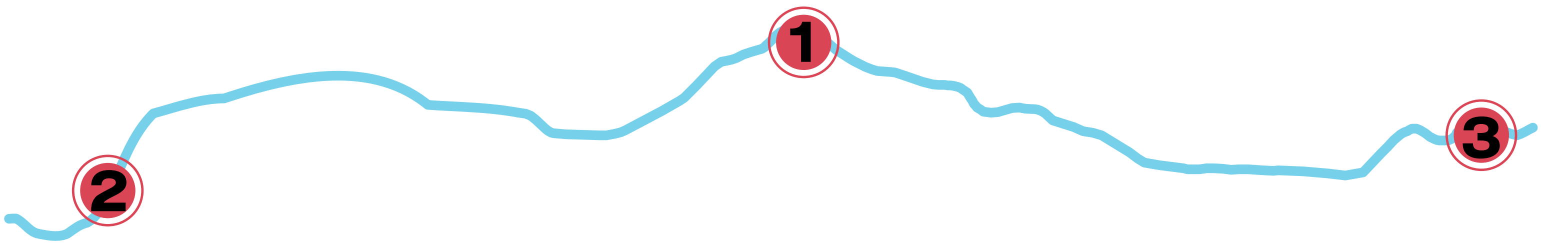


figure 5.47: corridor project phasing diagram (Charles McDowell)

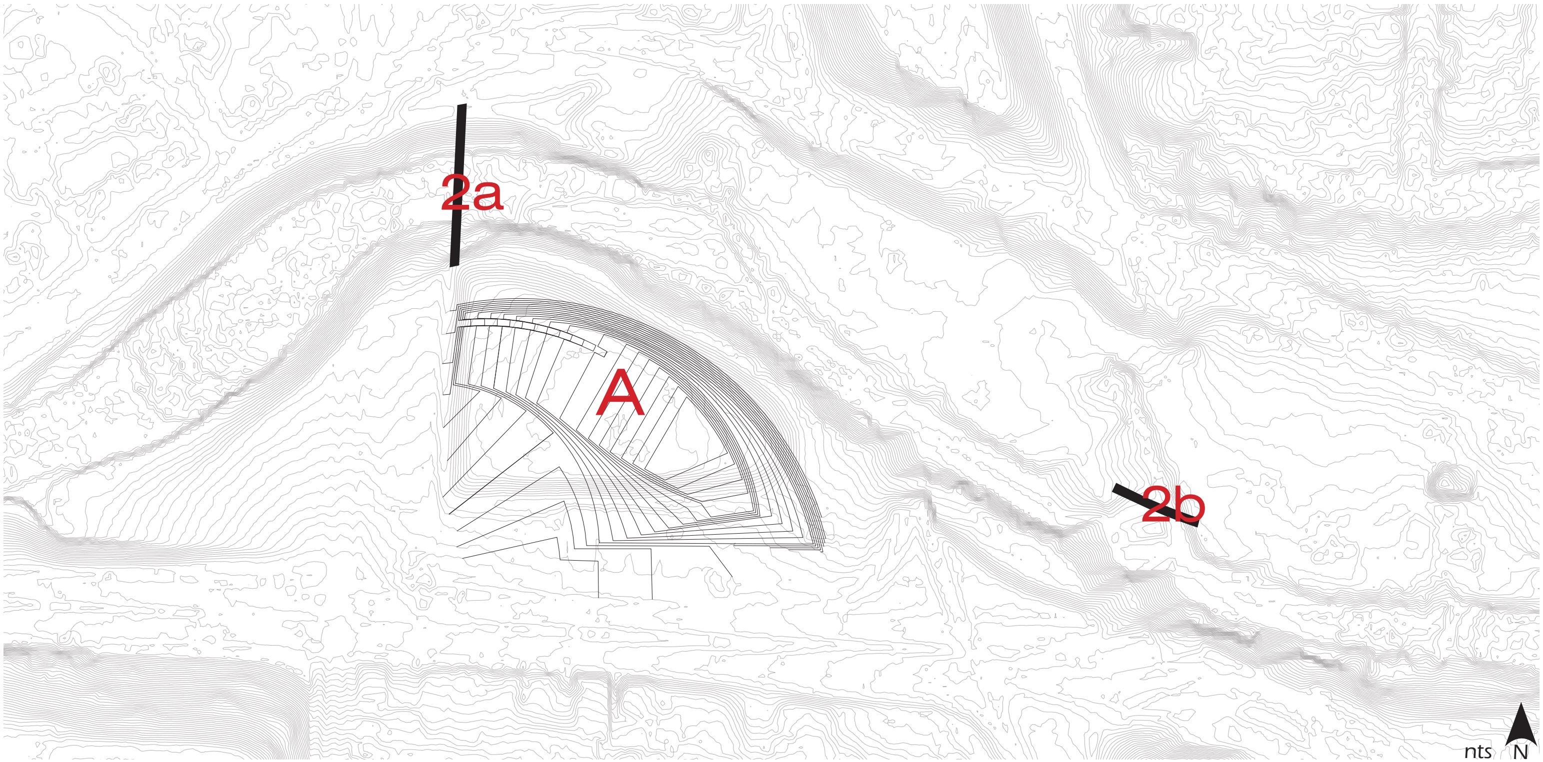


figure 5.48: site phasing diagram (Charles McDowell)

summary

Although each design alternative for the Woodland/ Bruce R. Watkins site responds to the major project goals, each takes a unique approach in achieving those goals. Alternative one achieves the goals while creating a unique environment which will draw users back to the site. Alternative two achieves the project goal while taking a more modest approach to the site design. This summary presents a comparison of each alternative in terms of material estimates and project goals.

1

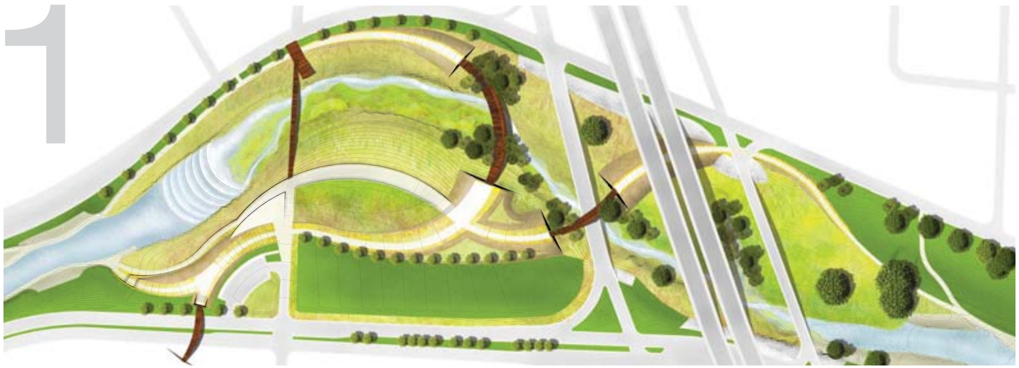


figure 5.49: alternative one master plan (Charles McDowell)

2

figure 5.50: alternative one master plan (Charles McDowell)

material estimates

Net Earthwork	8,967 Cu. Yd. Fill
Concrete Walks	48,629 sq. ft.
Hardscape Plazas	45,114 sq. ft.
Parking and Drive	16,306 sq. ft.
Number of Bridges	4
Mowed Turf	150,636 sq. ft.
Upland	0 sq. ft.
Upland Slopes	100,788 sq. ft.
Upland Transitional	109,289 sq. ft.
Lowland	224,091 sq. ft.
Constructed Wetland	46,063 sq. ft.
Natural Wetland	98,296 sq. ft.

Net Earthwork	104 Cu. Yd. Cut
Concrete Walks	71,935 sq. ft.
Hardscape Plazas	13,929 sq. ft.
Parking and Drive	18,349 sq. ft.
Number of Bridges	2
Mowed Turf	97,101 sq. ft
Upland	142,064 sq. ft.
Upland Slopes	72,935 sq. ft.
Upland Transitional	80,659 sq. ft.
Lowland	239,569 sq. ft.
Constructed Wetland	12,211 sq. ft.
Natural Wetland	98,296 sq. ft.

improve

The manipulation of the land forms is the primary strategy to improve the ecology of Brush Creek. The design proposal moves soil from the near stream areas and transfers them into mounds which flow through the site. By doing this, more area is available for inundation during flood events. The in-stream conditions are changed from a concrete lined channel to a dynamic meandering stream channel.

The current vegetation, which is currently turf, is replaced with vegetation zones that relate to soil moisture. This will help to increase infiltration while cleaning water that moves through the site.

In order to improve the ecology of Brush Creek, minimal site manipulation was used in the design proposal. The majority of the improvements are done through changes in vegetation patterns and in-stream improvements. The concrete lined channel of Brush Creek is removed and altered to a dynamic naturally meandering stream channel.

Mowed turf is replaced with upland, lowland, and wetland vegetation throughout the site in order to increase infiltration of water while also improving water quality.

connect

The proposal improves through-corridor connectivity as well as cross stream connectivity. Walkways connect on both sides of Brush Creek on the west side of the site and on the north side of Brush Creek on the west side of the site. There are three bridges that cross Brush Creek, thus drastically improving cross stream connections. A bridge crosses over Swope Parkway to allow for direct access to the Paseo Academy of the Performing Arts. The primary walkways are atop the landforms, and as such are elevated above any flooding that may occur within this section of the corridor.

educate

The proposal focuses on two themes related to ecology to educate users: water and vegetation. Because of the landforms flowing across the south side of Brush Creek, there is an opportunity for users to look down over the project (and relate the messages shown through interpretive signage to the processes they can see in front of them). Multiple lookout points offer opportunities to look over areas where the interaction of water and vegetation play a large roll in the ecology of Brush Creek. Walkways are directly related to different vegetation zones in order to expose the user to different processes. Users are encouraged to leave the defined walkways for hands on interaction.

conclusion

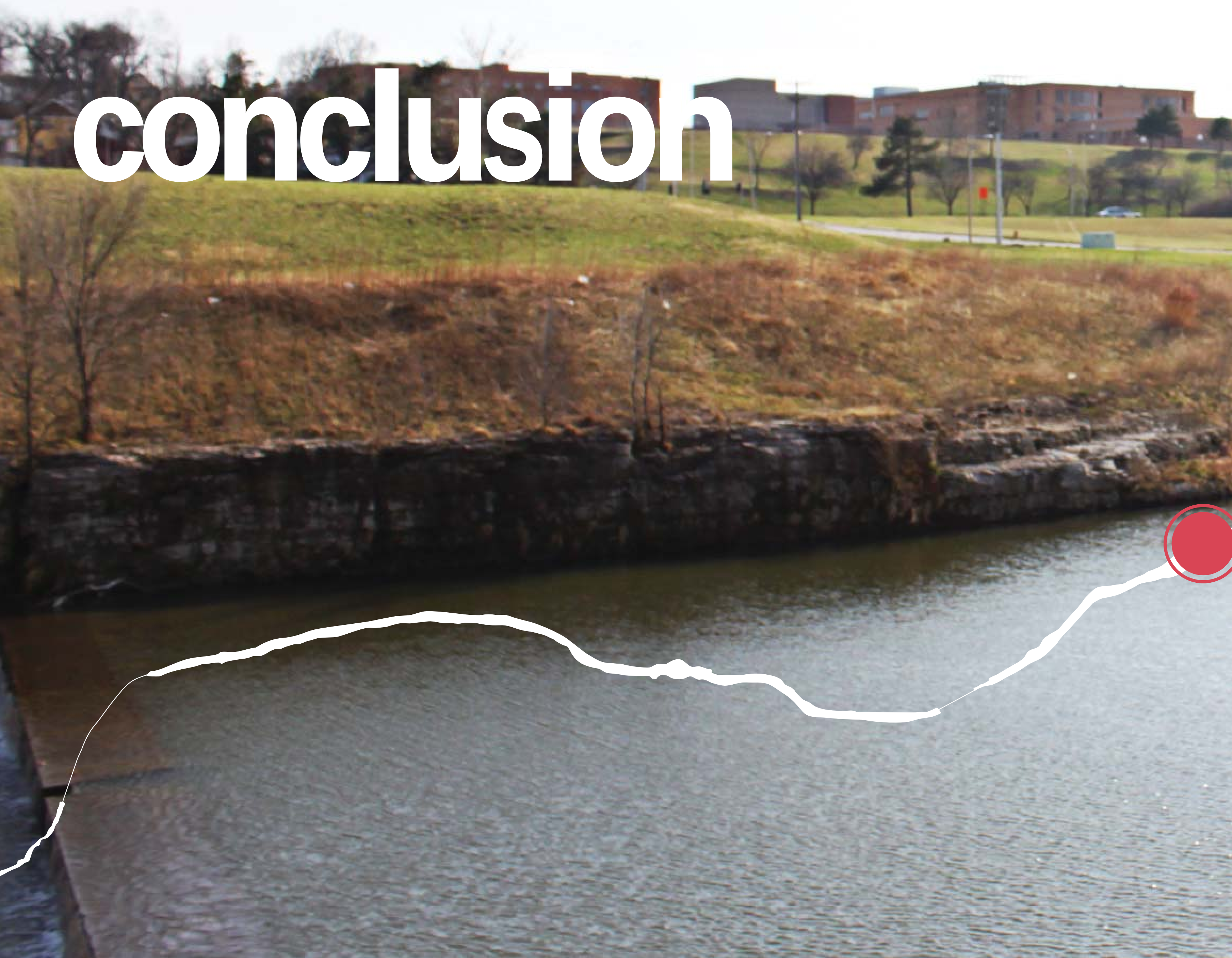


image source (Charles McDowell)

conclusions

process

Corridor Study

One of the major flaws in the corridor study was a lack of focus on site specific issues. The goal of the corridor study was to look at the corridor and the surrounding context in relation to the three project goals and to determine a site, or sites, for further site study. Although the corridor analysis was extensive, it did not take into account specific site conditions in order to prioritize the site selection.

After the sites were selected, there should have been a intermediate study between the corridor study and site study. This should have focused specifically on critical existing site conditions and the ability to achieve the project goals. If this was a part of the analysis process, a different prioritization or site selection may have occurred.

Since this process did not happen, the site selected for site design, Woodland/ Bruce R. Watkins, may actually not have the highest potential to improve, connect, and educate within the Brush Creek Corridor. The site has an excess amount of soil, placed there from an upstream excavation. Because of this, the ability to improve the environmental conditions of the corridor will be costly. Two alternatives show how excess soil could be managed.

limitations

Scope of Project

During the project development, it was my intent to look closely at the environmental conditions of the Brush Creek Corridor. I have some background knowledge in urban stream systems and how they function, but as I furthered my research on the topic and discovered the functions and interactions within these stream systems, I learned that I do not know enough about the topic to adequately respond to all relevant needs and conditions.
In order to address in-stream and near-stream environmental conditions, I would have needed a knowledge base in so many different fields that it would have been unreasonable to undertake this task without a collaborative design team.

In order to address the goals of Improve, Connect, and Educate, a larger effort is needed than redesigning three sites along the Brush Creek Corridor. To improve the environmental conditions of the Brush Creek Corridor, problems need to be addressed at the watershed, the corridor, and also the site scale. This project only addresses the issues a the site scale. The project may not even be locally successful if conditions upstream in the corridor and watershed are poor and there is not a comprehensive planning, design and implementation effort to address the project goals.

Data

There are many decisions that were made based on available data. The data collected was the most up to date data that could be obtained and therefore the project accurately responds to those conditions. For example, the 100 year and 500 year floodplain data obtained for this project is not up to date and does not respond to Army Corps of Engineers projects that alter the current conditions within the Brush Creek Corridor. This leads to an inaccurate, or imperfect, representation of the floodplain as it relates to the two design alternatives.

There were many limitations in relation to site design because of lack of data. I was unable to obtain relevant utility data to the scale that would have been helpful for site inventory and existing condition analysis. The dynamics of Brush Creek and the pumping system were another set of utility data I did not have access to. There are a series of pumps in Brush Creek that push water back upstream to control the flow and to keep Brush Creek flowing in certain areas at all times. This data could have influenced the in-stream design for both alternatives. Lack of data may have hindered my ability to respond to existing conditions with 100 percent accuracy but it did not have any impact on the project framework.

evaluation

Improve

Project goal: Improve local environmental conditions through ecological design.

At the site scale, both design alternatives improve environmental conditions through ecological design. This is primarily done through alterations to the in-stream and near stream conditions, including stream alignment, form alteration and vegetation changes.

Although the design solutions address the goal at the site scale, the proposed project will not be successful in improving the entire corridor as a stand alone project. A much larger initiative must be enacted to improve the Brush Creek Corridor. This initiative must address environmental issues at three different scales: watershed, corridor, and site scale. Improvements in stormwater management must be addressed within the entire Brush Creek Watershed. When the watershed is better managed, the corridor will be more stable, allowing improvement projects to occur throughout the corridor. These responses will exhibit similar characteristics as the proposed project at the Woodland/ Bruce R. Watkins site. These improvements will be implemented as retrofits within existing projects or newly constructed projects within the corridor.

Connect

Project goal: Connect the corridor for improved pedestrian use.

Both design alternatives connect users through the Brush Creek Corridor and across Brush Creek. Each alternative connects the east side of the site, through the site, to the west end of the site. The alternatives also provide crossing bridges to connect the north and south sides of Brush Creek together.

Connectivity throughout the Brush Creek Corridor is improved through the implementation of either design alternative at the Woodland/ Bruce R. Watkins site. Even with the completion of the proposed project, there is still lack of connectivity through and across the Brush Creek Corridor between State Line and the confluence with the Blue River. To achieve complete connectivity throughout the corridor, all of the areas, along the corridor, lacking pedestrian walkways, must link into the existing projects which currently support pedestrians. This will require the implementation of walkways in the West Plaza, Lake of the Enshriners reach, and Confluence with Blue River reach. Cross stream connections are currently limited to crossing streets and could be improved through the implementation of pedestrian bridges.

Educate

Project goal: Educate users to the environmental benefits of ecological design.

The proposed alternatives for the Woodland/ Bruce R. Watkins site educate users to the environmental benefits of ecological design through interpretive signage and user interaction. Interactive signage implemented in each of the proposals inform users to the ecological processes, on site, related to water and vegetation. Users are also exposed to these processes along walkways and overlook areas. The users are also encouraged to leave the defined walkways to interact with the ecology at a more personal level.

The ability to educate the users to the benefits of ecological design is not limited to the site. Strategies to educate users to the ecology of Brush Creek must be taught to the community in schools, educational sessions, and through community outreach programs. Signage and user interaction must occur throughout the entire corridor and must not be limited to the specific project sites. This will allow the educational messages to reach a broader audience and to focus on more ecological processes along Brush Creek. The project at the Woodland/ Bruce R. Watkins site can be a catalyst for ecological education throughout the area.

project summary

The Brush Creek Corridor was focused on in order to study the impacts of urbanization on stream systems and explore what designers can do to mitigate those impacts. Through research and precedent studies, the following four project goals were determined for the Brush Creek Corridor:

Improve local environmental conditions through ecological design.

Connect the corridor for improved pedestrian use.

Educate users to the environmental benefits of ecological design.

Reveal and interpret ecological processes and phenomena through design.

Improve, Connect, and Educate were determined to be the main goals of the project, The goal of Reveal is more of a site design strategy. After defining the goals for the project, two scales were identified to further define the project: a corridor study, and a site study.

The goals of the corridor study were to determine a specific site, or sites, that are suitable for design and development, and to prioritize the selected sites based on a select set of factors and criteria used to determine the order for site exploration, design, and development. The corridor study used the first three project goals as a base to determine the sites for the site study. The three sites selected for the site study were: West Plaza, Woodland/ Bruce R. Watkins, and Confluence with the Blue River.

Once the sites were selected and prioritized, a site study was conducted. The goals of the site study were to program the spaces to optimize on surrounding cultural and natural resources, and to implement site specific ecological and eco-revelatory designs that achieve the project goals and respond to the cultural and natural resources. The site study consisted of program analysis and analysis of critical existing conditions.

Proposed design solutions are represented by two different alternatives, each responding to the same design concept but envisioned in unique ways. Alternative 1 is a more costly solution to the design problem and will involve a greater amount of maintenance up front and over the long run. In Alternative 1, the site is manipulated significantly to amplify the users experience. Alternative 2 is less costly since the site is manipulated minimally and much is done to utilize vegetational changes within the existing context in order to achieve the project goals. Cost and maintenance estimates were provided for both alternatives so as to compare and contrast the two design ideas.

figure 6.1: water perspective - proposed (Charles McDowell)

appendix

image source (Charles McDowell)

literature review

PRIMARY

ecological design in urban stream corridors

Restoring Streams in Cities

- bank stabilization methods
- managing floodplains
- stream-channel restoration

Ecological Riverfront Design

- general principles
- planning principles
- design principles

- protect and restore
- regenerate
- compromise
- balance

brush creek kansas city, missouri

BRUSH CREEK DESIGN GUIDELINES

- waterways/ transportation
- hubs of activity
- heart of the city
- livability
- images

- linkages
- view corridors
- architectural character
- access
- open space
- landscape
- signage
- lighting

eco-revelatory design

ECO-REVELATORY DESIGN: NATURE CONSTRUCTED/ NATURE REVEALED

eco-revelatory design is landscape architecture intended to reveal and interpret ecological phenomena, processes and relationships

- abstraction
- simulation
- new uses
- signifying features
- exposed processes
- remembered histories
- changed perspectives

SUSTAINING BEAUTY THE PERFORMANCE OF APPEARANCE

- sustaining culture
- natural process over form
- hypernature
- performance of beauty
- constructing experience
- resilient and regenerative

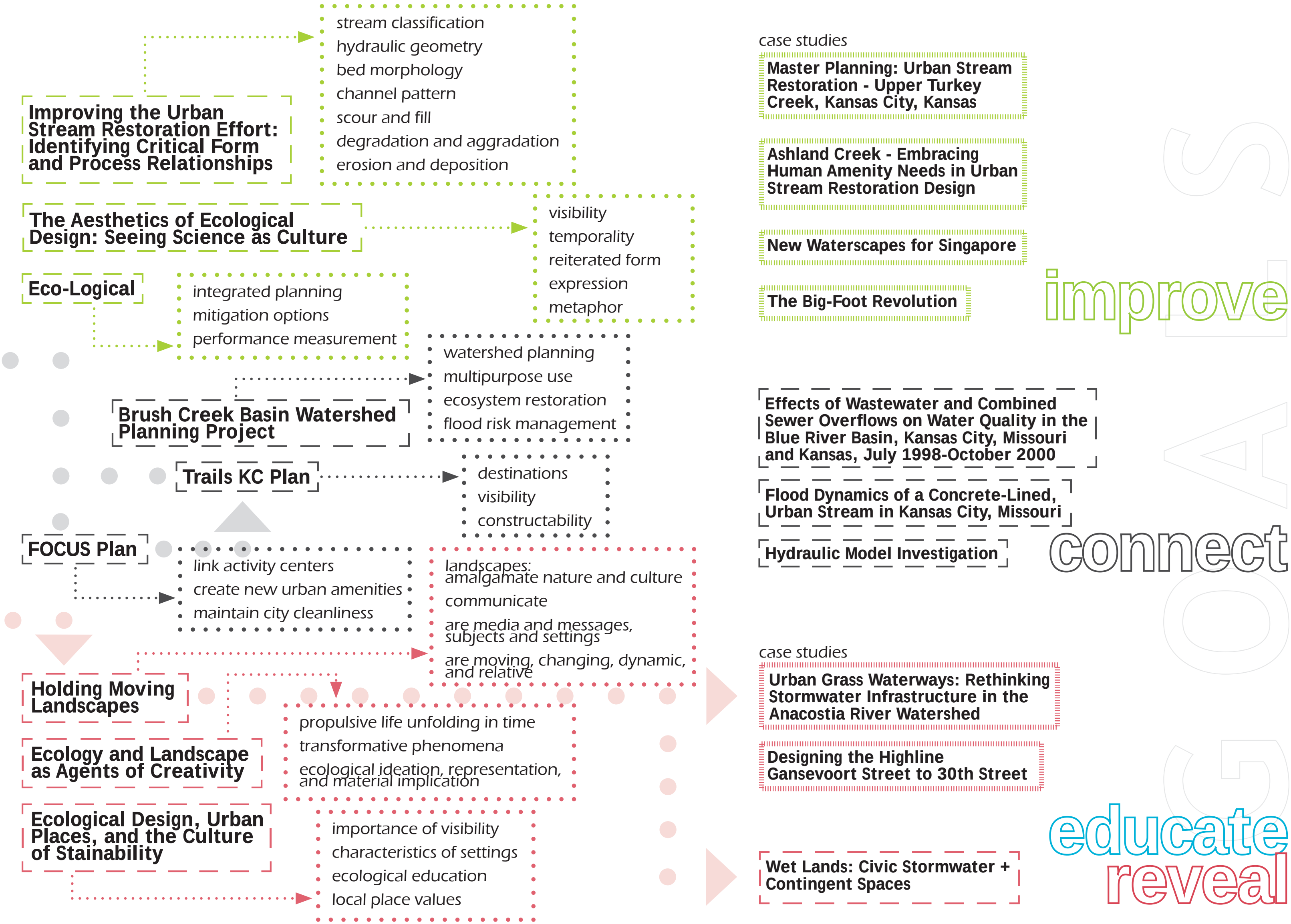


figure 7.1: literature map (Charles McDowell)

ecological design in urban stream corridors

Restoring Streams in Cities
A Guide for Planners, Policymakers, and Citizens
Ann L. Riley

Summary

Restoring Streams in Cities takes a wholistic approach in how urban stream systems function, are impacted, and are designed. This book first addresses the basic conflicts between the urban dweller and the potential erosion and flood risks to structures, roads, utilities, and drainage systems. Most communities decide to address urban stream systems in three ways: as an open storm sewer, as a closed storm sewer, or as community amenities.

Riley states that it is possible to address urban public works needs without sacrificing the option to develop a stream as a recreational resource with trail, paths, and urban sports. A stream can be used as a dynamic economic feature to draw shoppers and tourists to a business district as well as educational laboratories to be used in classrooms from kindergartens to universities.

Restoring Streams in Cities describes the planning processes used by communities to develop stream restoration projects, as well as what those projects look like.

Application

Although this book addresses urban stream systems and the potentials for restoring these systems, the process and final products differ slightly from the project goals and expected outcome. For the most part the Stream-Channel Restoration section addresses how to restore the urban stream to a natural state but not necessarily focusing on the implementation of user experience oriented spaces.

The balance of in stream dynamics is key to restoring an urban stream system. Ideally, the issues causing the imbalance, typically causing bank erosion and degrading, will be addressed at the watershed but if this is not possible, they can be addressed in-steam.

Channel grades are one of the main culprits of in stream imbalance. Culverts, channel straightening, and removal of meanders are the greatest influences on the slopes of channels. The solutions to these problems can be placement of boulders, reshaping the channel width and depth, or constructed features like weirs and drop structures.

Stream bank restoration is also addressed. Restoration strategies are based on returning plant cover to stream banks because of the superior ability of plants to hold soil, protect banks, and create a stabilizing influence on the stream.

Riley specifically addresses stream bank restoration for urban environments where the conditions make it extremely difficult to implement typical restoration techniques. These spaces may be too narrow for a stream to pass through them with supporting a proper floodplain, meander, and channel width. This will be the case in the Brush Creek Corridor. When all possibilities of attaining the desired bankfull channel dimensions, meanders, and floodplain have been exhausted, the designer then must consider how to best compromise the creek's natural dynamics. These sites may require structural components such as jacks, lunkers, dirt-filled gabions, rock work, and cribwalls while other sites may require only live and dead plant materials.

ecological design in urban stream corridors

Ecological Riverfront Design
Restoring Rivers, Connecting Communities
Betsy Otto, Kathleen McCormick, and Micheal Leccese

Summary

Ecological Riverfront Design gives a generalized background to the unique approach of ecological design in an urban setting while also providing guidelines, principles of design, and examples of application. General background includes the history of urban riverfront design and the benefits of a more fully integrated connection between the urban environment and ecological considerations.

The bulk of the book lies in the recommendations and guiding principles for ecologically sound urban riverfront development. These include general perspectives, planning principles, as well as, more detailed, design principles.

There are also two in-depth case studies that show the application of the principles. These projects are the Chicago River and the Willamette River in Portland. Although these examples are identified, they cannot be viewed as a direct application of the text because some, not all of the principles and design considerations were implemented. Each site is dynamic and unique in its own way and in no way are the principles applicable to every site, they are just general guidelines to design and planning.

Application

Ecological Riverfront Design outlines eight design principle. These provide an overview of some of the most effective preservation techniques, including protective zoning, buffer conservation, and open space preservation programs. It also describes the best practices for reconstructing the ecological features of urban rivers, including efforts to remove dams, reduce pollution from runoff, rebuild in-stream habitat, and restore healthy, natural riverbanks. These design principals are as follows:

Preserve natural river features and functions
Through zoning, land preservation, and careful site design, communities can protect sensitive areas of rivers and streams from development. As a part of the process, ecological goals should be determined to identify missing or altered natural features.

Buffer sensitive natural areas
A network of buffers act as the right-of-way for a stream and functions as an integral part of the stream ecosystem. Buffers of varying widths protect natural areas around rivers and streams, especially fragile areas such as steep slopes and wetlands.

Restore riparian and in-stream habitats
Restoring habitats requires a multi-scalar approach to design at the watershed level and also including elements such as planted buffer zones, stormwater quality projects, dams and reservoirs avoided or removed. Habitat restoration should combine natural channel design, habitat structures, vegetation management, and bioengineering.

Use nonstructural alternatives to manage water
Structural solutions to water management has harmed water quality, caused flooding, and destroyed wildlife habitat. Natural and semi-natural solutions are the most successful ways to restore a stream system to a stable healthy state.

Reduce hardscapes
Hardscapes degrade urban rivers because they do not absorb stormwater. These surfaces increase the volume, velocity, and temperature of runoff.

Manage stormwater on site and use nonstructural approaches
Waterfront projects should capture, store, and infiltrate or otherwise naturally treat and release stormwater. Systems like wetlands and bioswales can provide habitat benefits along with stormwater benefits.

Balance recreational and public access goals with river protection
Waterfront projects should provide facilities for as many recreational uses as possible while balancing conflicts and managing possible overuse.

Incorporate information about a river's natural and cultural history into the design of riverfront features, public art, and interpretive signs
Ecological interpretation and education are important because so many natural systems have been erased and the stream's history and function may not be obvious to the public.

brush creek
kansas city, missouri

Brush Creek Design Guidelines

The City of Kansas City Missouri - Parks and Recreation Department

Background

The Brush Creek Design Guidelines were formed after a redesign of the corridor was deemed necessary following the flood of 1977. The Board of Parks and Recreation Commissioners requested these design guidelines in order to further expand the impact of the flood control and beautification project to the entire Brush Creek Corridor.

The initial phase of the Brush Creek project was completed in 1995 and opened to the public. Future phases will include the development of recreational opportunities along the entire corridor. These opportunities will include boat rides, amphitheaters with musical events, biking, walking, sports and other activities associated with the park system. Additional landscaping and site amenities will enhance use of the corridor.

The guidelines are a tool for review of proposed development in the Brush Creek Corridor. The guidelines provide a direction for the development of the Brush Creek Corridor. The guidelines are also intended to guide the character of the Corridor.

General Intent

- Improve the quality of life and livability of Kansas City by increasing the quality of its parks and open space, and achieving high standards of design in public improvements and private development near Brush Creek.
- Maintain and improve the image of the area surrounding Brush Creek.
- Create confidence in and provide assurance of the consistent quality of development around Brush Creek.
- Promote increased public use of Brush Creek public improvements.
- Maintain and reinforce public investment in Brush Creek, including investment in beautification and flood control.
- Use public investment in Brush Creek to create and encourage additional development in the area that is designed in such a way as to further create value in the area.
- Create a climate for quality development and redevelopment, and provide the design framework for public and private decisions about development and redevelopment.
- Tie together the eastern and western parts of the city along Brush Creek with quality development.

Design Guidelines

The Brush Creek Design Guidelines outlines 12 different guidelines for the Brush Creek Corridor. Each guideline defines the term and identifies the intent and purpose of the guideline. Following the intent, the specific guidelines are listed. The following are the guidelines are those specifically relating to this project.

Linkages
Definition: physical and/or visual connections between important elements, including focal points and activity centers, inside and outside the project.
Intent/purpose: to strengthen relationships and encourage movement between important elements inside and outside the project; to improve the ease of orientation within the project; to help incorporate the image of the surrounding area within the project area; reinforce east/west connections with the city.

View Corridors
Definition: key visual connections between two points.
Intent/purpose: to preserve views of significant features within the Brush Creek corridor in order to help fix a positive image of the corridor in the minds of residents and visitors, aid the public in becoming oriented within the area, and heighten "entrance experiences"; to make the spatial relationships understandable through the visual tie between various elements in the landscape; to provide appropriate views into, out of, and within a development project, especially views of the creek.

Access
Definition: the means of providing for physical movement into and out of a site by vehicles and pedestrians in order to enable the site to be utilized; a determining factor in the successful development of the site.
Intent/purpose: provide opportunities for the public to walk or drive to and within the development while minimizing conflicts between the two; to promote an orderly, visually pleasing, active street environment for workers, residents and visitors; to accommodate the automobile but not at the expense of the pedestrian; to provide adequate and efficient servicing of the development by trucks and utility vehicles, but to minimize the visual and noise impact of such service.

Open Space
Definition: all areas not occupied by buildings or structures.
Intent/purpose: to provide positive space that is used to add value to the built environment; to provide opportunities for people to interact or feel comfortable, whether they are involved in active or passive enjoyment of the space; to complement and help unify the development; to preserve view corridors, to provide a link to Brush Creek, and to break up building massing so as to provide a more human scale.

Landscape
Definition: plantings and associated hardscape (walls, solid edges/borders) within public and private open space.
Intent/purpose: to provide a setting or context for structures in a development that can provide the following benefits: minimize runoff, help cool the air, help purify the air by absorbing exhaust gases and giving off pure oxygen, help lower energy costs, help provide shade and comfort for pedestrians, help muffle noise, provide visual screens, provide a sense of scale that makes people feel more comfortable, contributes to surrounding property values, and attracts and gives pleasure to customers, clients and citizens by providing a pleasant transition from adjacent roadways into the development.

Signage
Definition: a system of display boards or surfaces used for directions, identification, instructions or advertising; usually consisting of lettering, pictures, diagrams, decoration, etc. often in combination on a contrasting background surface.
Intent/purpose: to provide a clear, easily understandable, coordinated method of identifying and giving directions to projects and places that is complementary to and not in conflict with adjacent uses.

Lighting
Definition: natural and artificial sources of illumination, particularly street lighting, pedestrian level lighting, lighting of signs and architectural features.
Intent/purpose: to enable people within the development or passing by the development to see well enough to find their destinations and to conduct their activities safely; to enliven a development and set the overall mood of the development; to help increase the sense of security and not negatively impact surrounding residences.

eco-revelatory design

Eco-Revelatory Design:
Nature Constructed/ Nature Revealed
Landscape Journal

Summary

The concept of eco-revelatory design is introduced in this special issue of Landscape Journal. Because this concept is unfamiliar to most, the issue was outlined in a unique way. The issue discusses the idea of eco-revelatory design in two ways: an exhibit of projects related to the topic, and a series of essays responding to the projects and to the concept as a whole. The goal of the issue is to stimulate creative, analytical, and critical investigation and discussion not only on eco-revelatory design, but also on landscape architecture and the integration of ecological design. In the documented projects, both nature and how nature is viewed are dynamic.

An example that illustrates the application of eco-revelatory design at the site scale is seen in Wet Lands: Civic Stormater + Contingent Spaces by Kathy Poole. Poole discusses the idea of wetlands and how dynamic they are in terms of their function, processes, and how, in reality, they can be both wet and/or dry. This leads to difficulty in representation and in design. These difficulties are described and then the challenges of spacial integration are applied in one project example which includes the elements of sand/deposition theater, marsh/pool classroom, and entry/settling basin.

Quotes

"Eco-revelatory design is landscape architecture intended to reveal and interpret ecological phenomena, processes and relationships."

"Landscape architects construct nature. In designing landscapes, they shape and intervene in interactive geophysical, biological and cultural systems."

"Landscape architects not only design landscape forms and functions, they design our experience. They direct our vision and our movement; they emphasize, they accentuate, they reveal. "

"explore the possibilities presented by looking to the ecology of the city to inform design in a manner that fosters a renewed understanding of infrastructure, ecology, and the civic realm."

"Landscapes are media as well as messages, subjects as well as settings."

"landscapes amalgamate nature and culture and that designed landscapes potentially have communicative power."

"If it is not the stuff of, then it is the realm of, interactive properties and materials, stable and unstable patterns, shifting appearances, changing relationships, waning and waxing life and death."

"This attention to history is also just one of the ways in which landscapes are construed as moving, changing, dynamic, and relative.

Application

The concepts illustrated throughout the exhibit pieces and the complementary essays directly relate to and inform the project goals for the Brush Creek Corridor: improve, connect, educate, and reveal. The examples in the exhibit section relate to site design and the implementation and theoretical application of eco-revelatory design.

This special issue of Landscape Journal has had a direct influence on the project goal of reveal. The definition used defining this goal is taken from the introduction to this issue. This concept of eco-revelatory design is to be specifically applied through design and development through site design within the Brush Creek Corridor. By revealing to the users of the project, the users can then start to understand how these systems function. This leading to a better understanding of the purpose and value of ecological design and natural systems.

One of the goal within the idea of eco-revelatory design is to perform. Along with identifying the natural system being demonstrated, the system must function properly in order for the underlying processes to be revealed. The performance aspects of the system help to improve local environmental conditions.

Sustaining Beauty
The Performance of Appearance: A Manifesto in Three Parts

Elizabeth K. Meyer

Summary

Sustaining Beauty examines the role of beauty and aesthetics in sustainable design. The article argues that it will take more than just ecologically regenerative designs for the culture to be sustainable, that what is needed are designed landscapes that provoke those who experience them to become more aware of how their actions affect the environment, and to care enough to make changes. Meyer argues that this involves considering the role of aesthetic environmental experiences in order to gain a more environmentally respectful perspective.

This argument is made through a manifesto. The following are the topics which address this issue:

1. Sustaining culture through landscapes
2. Cultivating hybrids: language of landscape
3. Beyond ecological performance
4. Natural process over natural form
5. Hypernature: the recognition of art
6. The performance of beauty
7. Sustainable design = constructing experiences
8. Sustainable beauty is particular, not generic
9. Sustainable beauty is dynamic, not static
10. Enduring beauty is resilient and regenerative
11. Landscape agency: from experiences to sustainable praxis

Quotes

"aesthetic experience can lead to recognition, empathy, love, respect and care for the environment"

"contemporary theory and practice of sustainable landscape design have little regard for the performance of appearance, particularly beauty."

"beauty was 'that quality or combination of qualities which affords keen pleasure to the other senses (e.g. hearing) or which charms the intellectual or moral faculties, through inherent grace, or fitness to a desired end."

"beauty is a key component in developing an environmental ethic."

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

"Sustainable landscape design can reveal natural cycles such as seasonal floods, and regenerate natural processes- and do so while intersecting with social routines and spatial practices."

Application

The ideas and concepts represented in Meyer's eleven point manifesto directly relate to eco-revelatory design. Meyer states that through performance and the visibility of performance people will learn about the landscape and begin to form an ethic. Experience is a pivotal design consideration in terms of the success of this type of design.

All of the points in the manifesto have validity in relation to the project goals and expected outcomes but some relate more than others to site scale design. The idea of hypernature can be successful in site design but must directly relate to the exact context both physically and socially. Although Meyer offers many concepts of design, the examples are limited and some areas and are lacking in others.

Designed natural systems must preform, they must be seen, and they must be unique. These are the main ideas taken from the manifesto that will be applied to the Brush Creek Corridor.

corridor study

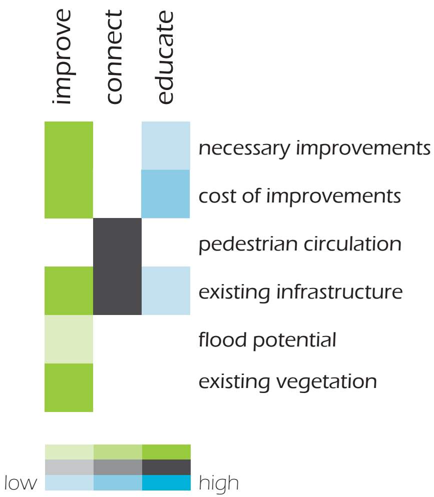
improve vulnerability study
current project status

The current project status is defined by reach and was classified by the Water Services Department of Kansas City, Missouri. The actual project goals and elements are also defined by the Water Services Department.

Completed Projects:
Plaza Reach - channel enhancements, bridge replacement
Troost - channel enhancements, bridge replacement
Paseo Complex - channel enhancements, bridge replacement
Woodland - channel enhancements, bridge removal
Prospect - channel enhancements, bridge replacement
Lake of the Enshriners - enhancements

Future Projects:
West Plaza - channel enhancements, enhancements, bridge replacement
Woodland - enhancements
Bruce R. Watkins - channel enhancements
Prospect - enhancements
Lake of the Enshriners - enhancements
Confluence with the blue river - channel enhancements

factors of influence



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planned project - high priority

planned project - medium priority

completed project - low priority

brush creek

The project areas completed by the Army Corps of Engineers where the channel has been enhanced to manage flooding will be eliminated from the study and will not be considered for site selection.

Projects in bold represent projects that are a high priority for the city, are unplanned, but will be substantially large projects in the future.

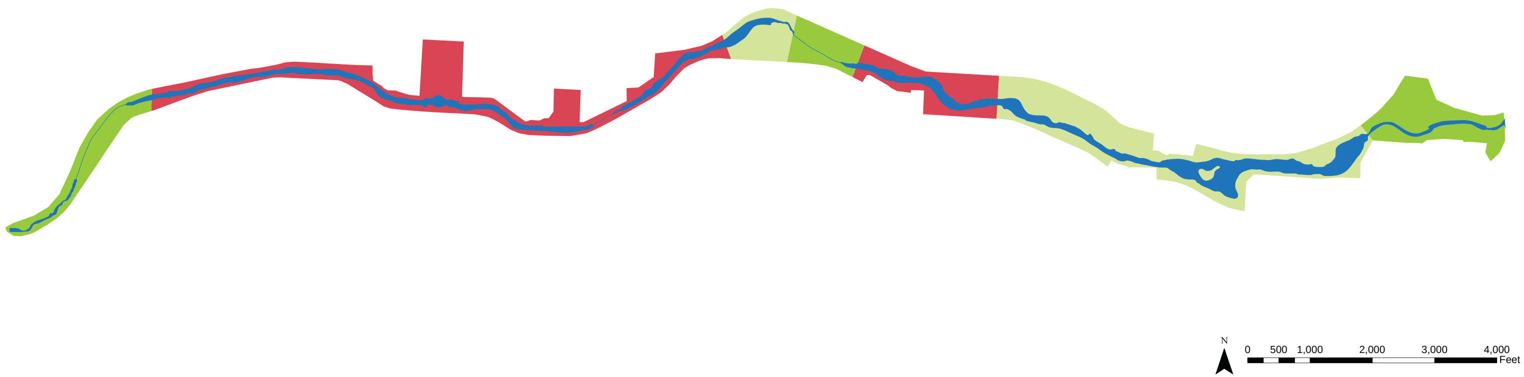


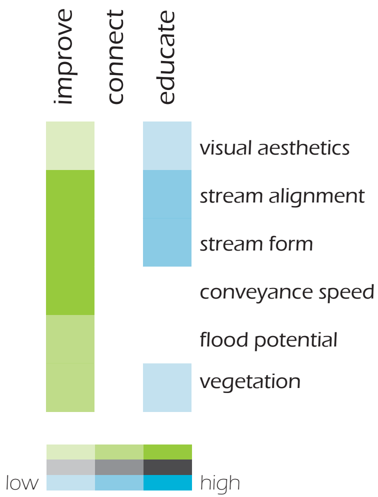
figure 7.2: current project status (adapted from The City of Kansas City, Mo., Water Services Department)

improve vulnerability study
in-stream conditions

In-stream conditions directly relate to the stream channel and flow area of the stream. Conditions were assessed based on the area of Brush Creek within the bankfull width. The conditions vary from a degraded natural channel to a degraded constructed channel to a constructed channel in good condition. These different conditions are assessed based on the potential for environmental improvements.

The areas with the highest potential to improve in-stream conditions are the concrete lined channel and the constructed and natural degraded areas. The areas of concrete lined channel are outdated and have no value in terms of the local environmental conditions. The degraded natural areas show signs of an unstable stream, one of the major issues being stream bank erosion. The constructed degraded areas have been channelized or concrete lined but are in a dilapidated state that needs improvement.

factors of influence



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concrete lined - high priority

degraded - medium - high priority

semi-natural - constructed - medium priority

engineered for flood control - low priority

corridor study boundary

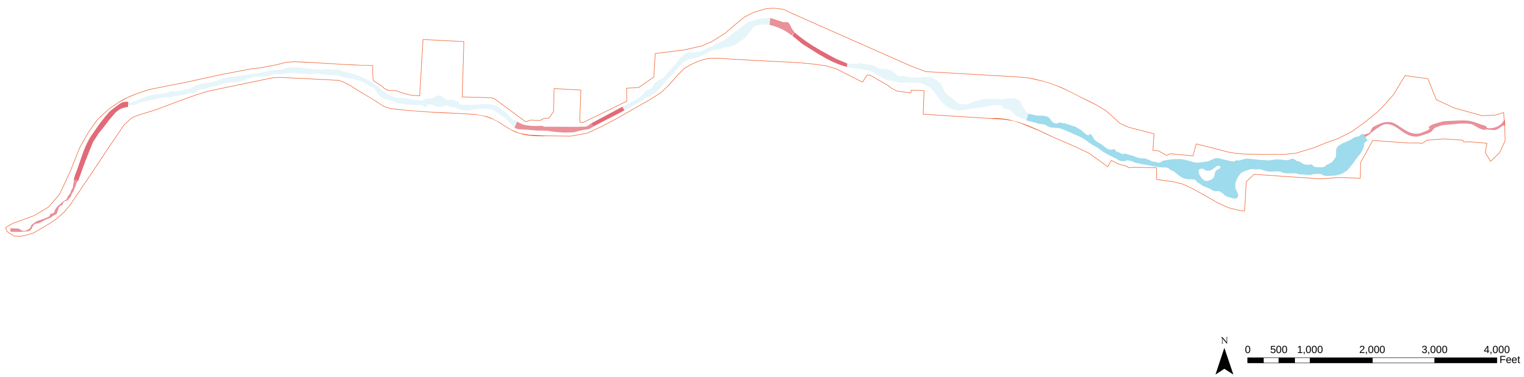


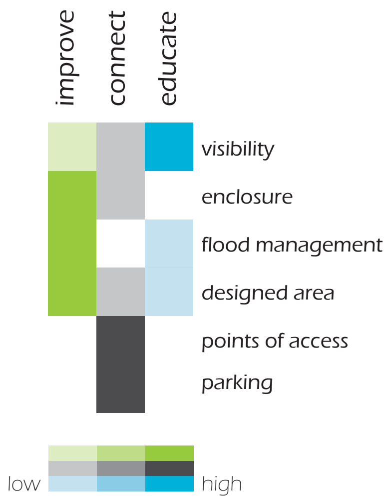
figure 7.3: in-stream conditions (Charles McDowell)

improve vulnerability study
degree of confinement

The relationship between the stream and adjacent space is important in determining whether there is enough space to implement site design strategies addressing the project goals. The degree of confinement varies throughout the corridor from where it is extremely confined near The Plaza to where there is substantial adjacent open space by the Lake of the Enshriners.

The corridor study boundary relates to the stream confinement, following barriers and open spaces. Although the boundary addresses confinement, a method has been defined to assess this issue. A buffer of 100 yards was applied to the center line of the stream for a general understanding of the degree of confinement adjacent to the stream. The method addresses the fact that there may be more or less confinement on one side of the stream than the other. The classifications take this into consideration.

factors of influence



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low degree of confinement

moderate degree of confinement

high degree of confinement

brush creek

corridor study boundary

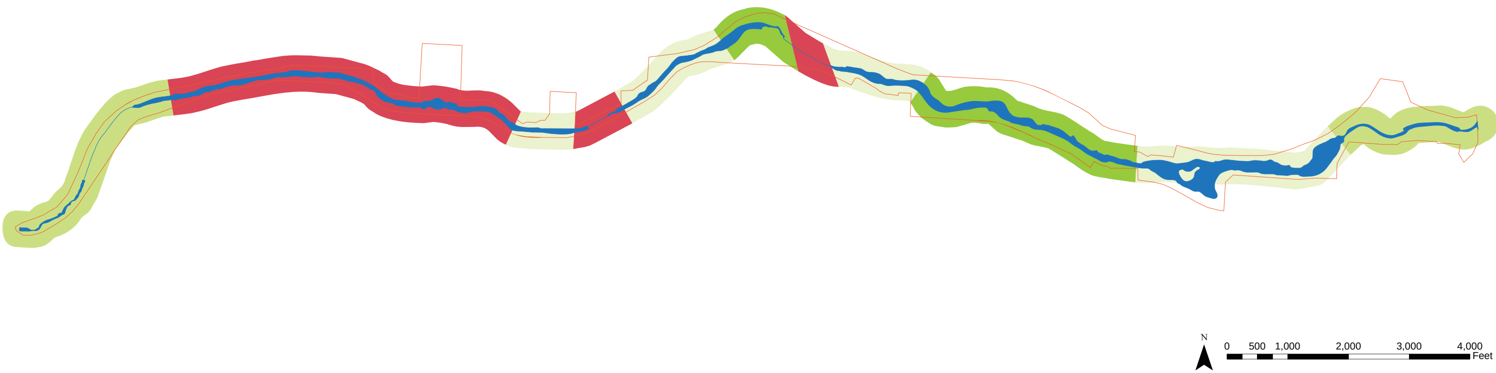


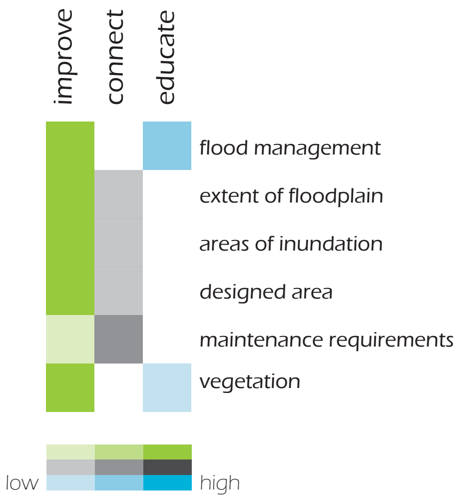
figure 7.4: degree of confinement (Charles McDowell)

improve vulnerability study
flood prone areas

The Brush Creek Corridor has undergone much development both near-stream and in-stream which has had much influence on the flood prone areas. The development near-stream has lead to increased flood hazards to structures, roads, and utilities. In response, the in-stream conditions have been adjusted along much of the corridor to deal with the flood hazards, sending flood flows downstream. The floodplain data has been updated to reflect the changes in the in-stream and near-stream conditions.

Identifying flood prone areas will help to determine areas where it is possible to isolate localized flood hazards and manage them within an area. Areas where flood potential is localized within and adjacent to the study area and where adjacent buildings are being flooded are identified as opportunities for improvements.

factors of influence



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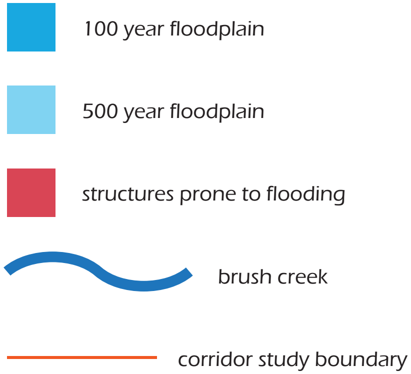


figure 7.5: flood prone areas (adapted from MARC)

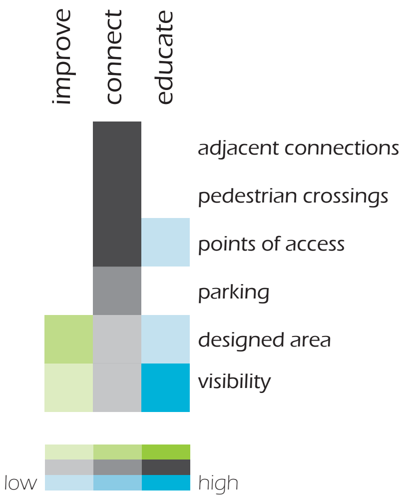
connect suitability study
pedestrian circulation

There are trails and walkways located throughout the corridor, but there are also sections that contain no walkways or trails. The walkways and trails that are currently in the corridor are in good condition other than after flood events when sediment accumulates.

The main goal of the corridor study in terms of connection is to identify sites and locations where there is potential to add new trails and walkways and add them to the existing network. There are five major areas where there are no trails and walkways. These areas are located throughout the corridor creating an extreme disconnect in relation to the entire corridor.

Access is important when viewed in relation to the surrounding context. Along with having no trails or walkways, the five identified areas offer no opportunities to access Brush Creek.

factors of influence



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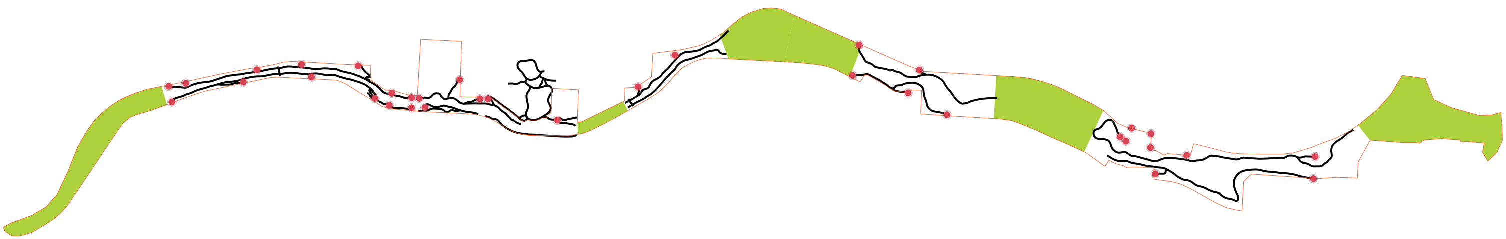
areas without pedestrian connections

existing points of pedestrian access

existing pedestrian walkways

corridor study boundary



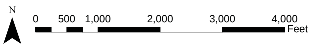


figure 7.6: pedestrian circulation (Charles McDowell)

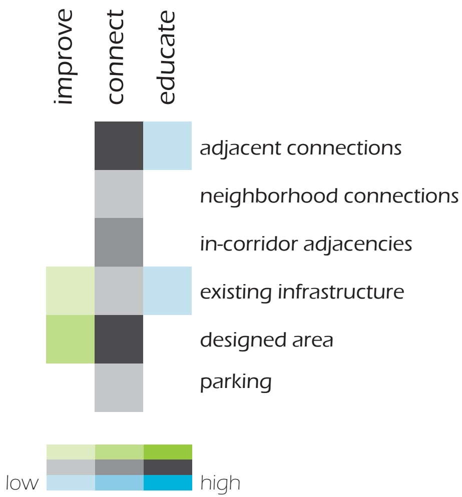
connect suitability study
near-stream conditions

The Brush Creek Corridor contains a large park system linking many parks along the corridor. Even though the corridor is lined with parks, the parks are generally not linked, by trails or walkways, to one another. Adjacent parks also provide the opportunity for increased linkage from surrounding areas.

On the western end of the corridor, the park space is confined between the west and east throughways of Ward Parkway. This condition continues through The Plaza. Around Highway 71 the corridor opens up to Brush Creek Park. This section of the stream corridor is very wide with park space on both sides.

Although the parkway system is fairly complete throughout the corridor, connections between existing park space are lacking and are the highest priority when addressing the parks in the corridor study.

factors of influence



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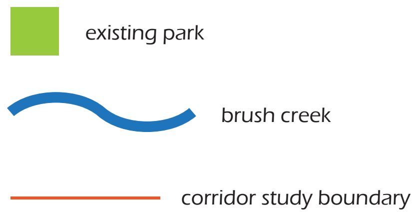


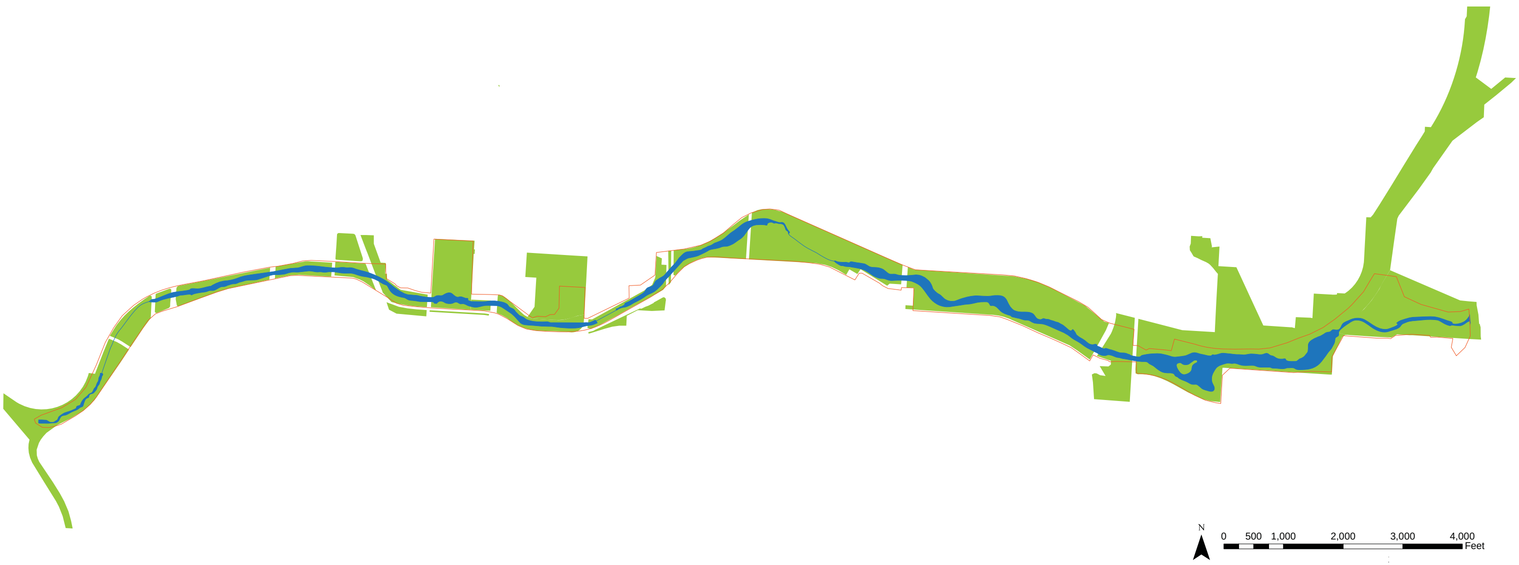


figure 7.7: near-stream conditions (adapted from MARC)

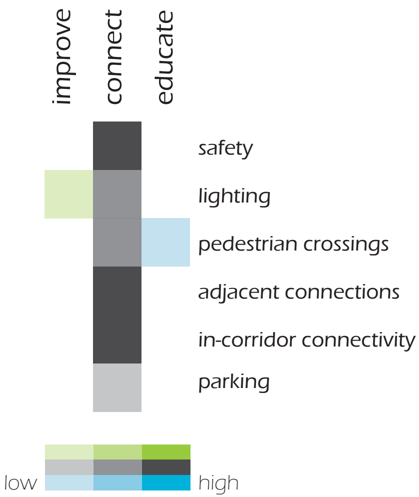
connect suitability study
adjacent and crossing roads

The most influential barriers on the Brush Creek Corridor in terms of connectivity are the crossing and adjacent roads. Although these are barriers that inhibit connectivity, the barrier actually creates a huge opportunity for improving the connectivity of the entire corridor.

The crossing road that creates the biggest disconnect in the corridor is Highway 71, also known as Bruce. R. Watkins Drive. There are no crossing paths or bridges over this highway. The highway is bridged over Bruch Creek, but there are no walkways or lighting under the bridge, creating a safety issue in this portion of the corridor. The other area where there are road barriers are west of The Plaza. There is no in-corridor crossing opportunities for the roads here.

Adjacent roads affect the connectivity from surrounding areas into the corridor.

factors of influence



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crossing road - high disconnect

crossing road - moderate disconnect

crossing road - low disconnect

adjacent road

brush creek

corridor study boundary

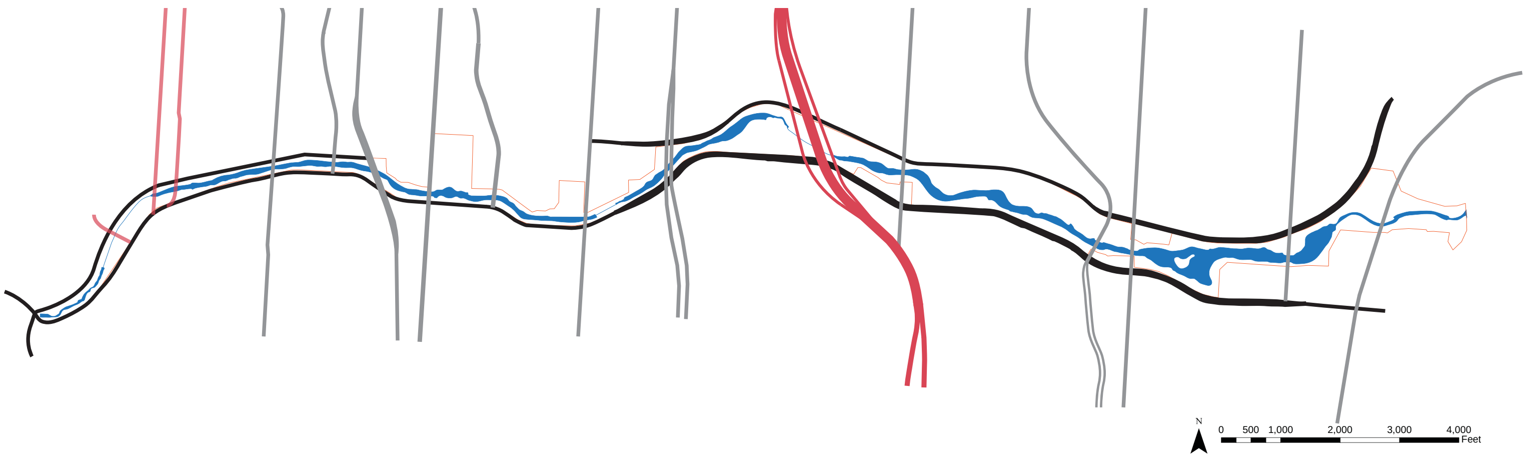


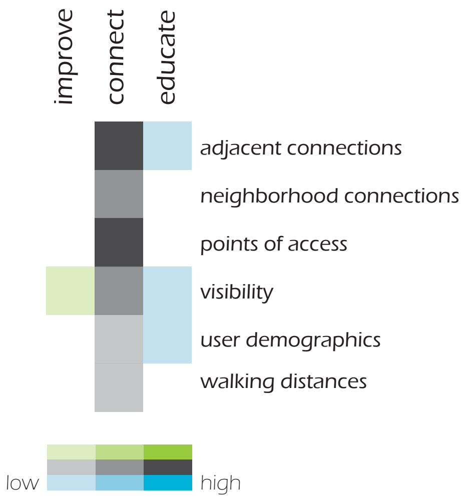
figure 7.8: adjacent and crossing roads (adapted from MARC)

connect suitability study
population

Based on population per square mile, the area surrounding the western end of the Brush Creek Corridor is one of the densest areas in all of Kansas City. By locating population densities, key areas and specific locations can be identified to optimize physical and social connections to the corridor. Population densities are viewed as a whole and not broken down by specific demographics because connecting the highest number of the general population is most important for this study.

As a general trend, the population per square mile gets less dense from the west end of the study area to the east. The highest populations are located around the Country Club Plaza because there are apartments and lofts. The majority of the corridor to the east is surrounded by residential neighborhoods, thus having a much lower density.

factors of influence



legend

1400 - 2600 people per square mile

9400 - 13999 people per square mile

5800 - 9399 people per square mile

2700 - 5799 people per square mile

0 - 2699 people per square mile

brush creek

corridor study boundary

figure 7.9: population - density (adapted from MARC)

educate suitability study
special interest areas

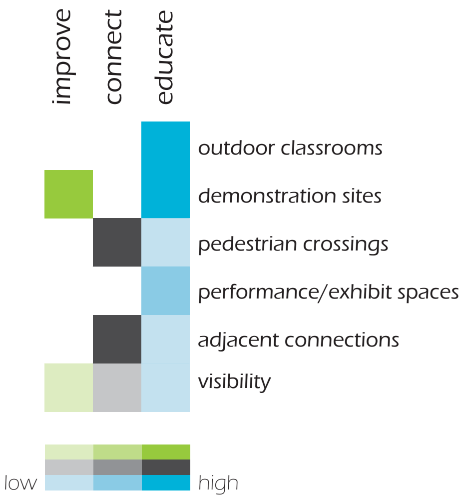
Special interest areas represent an organization or destination which targets a very select group of the population.

The Kauffman Foundation Headquarters and the Anita B. Gorman Discovery Center are both community outreach organizations with a direct physical relationship to the corridor. The Discovery Center is focused on environmental education and on the demonstration and performance of natural processes.

The Kansas City Art Institute and the Nelson-Atkins Museum of Art are both located within a half mile from Brush Creek. The Paseo Academy of Preforming Arts and the Kansas City Middle School of the Arts are within a quarter mile from Brush Creek.

The Country Club Plaza, a shopping and entertainment district is located adjacent to Brush Creek. Brush Creek has the highest visibility and usage in this area.

factors of influence



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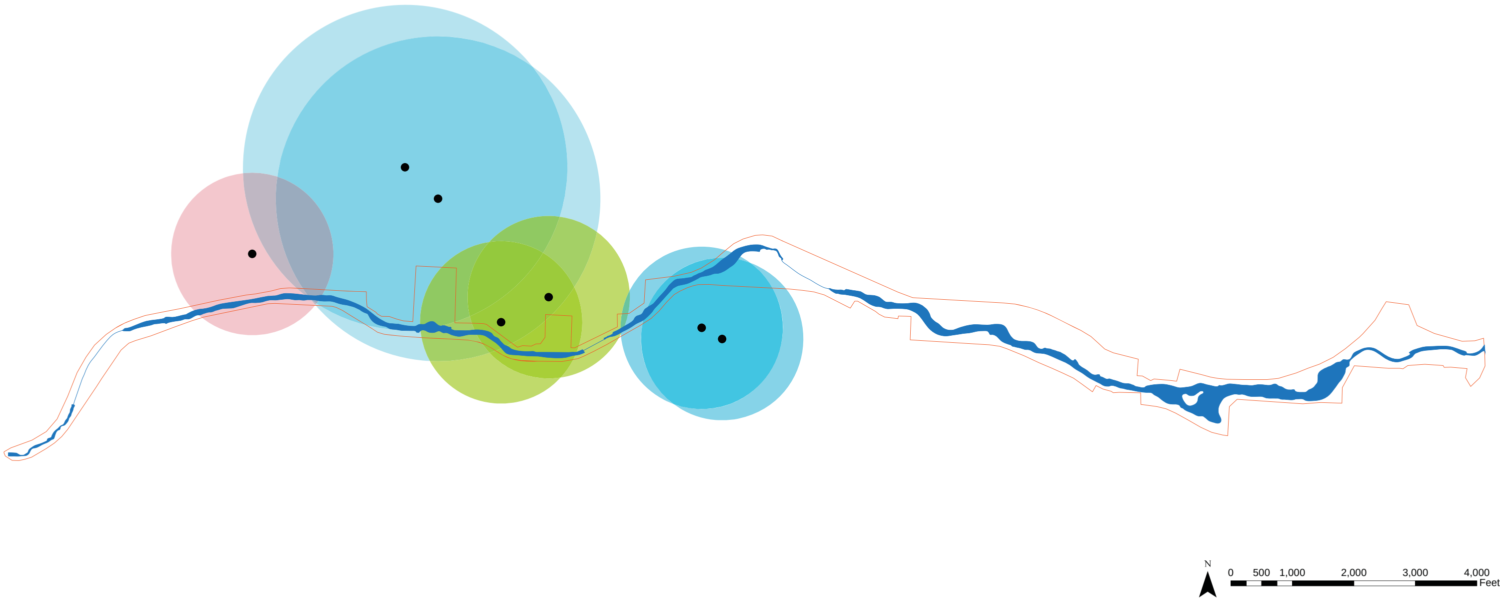


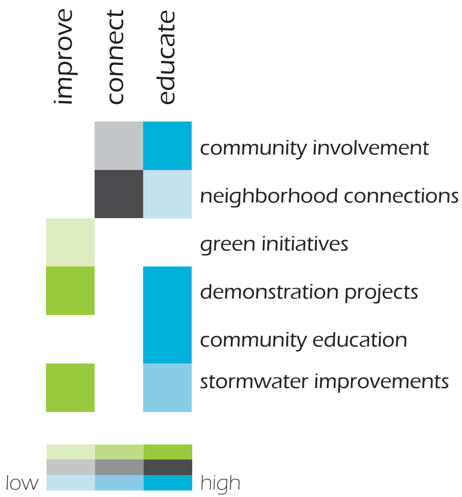
figure 7.10: special interest areas (adapted from MARC)

educate suitability study
green impact zone

The Green Impact Zone is an effort to focus federal funds on projects in a targeted area bounded by 39th St. on the north, 51st St. on the south, Troost Ave. on the west, and Prospect to 47th to Swope Parkway on the east. The initiative includes housing rehab, weatherization programs, community policing, services, job training, placement, health and wellness programs, built around a comprehensive neighborhood outreach program and using sustainability as a catalyst for this transformation. (MARC)

One of the zone's community based approaches is the development and implementation of a sustainability strategy for the zone, including energy efficiency and renewable energy sources and green solutions to water and waste water issues. This initiative can be a catalyst for community environmental involvement and spur further growth along the Brush Creek Corridor.

factors of influence



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green impact zone

brush creek

corridor study boundary

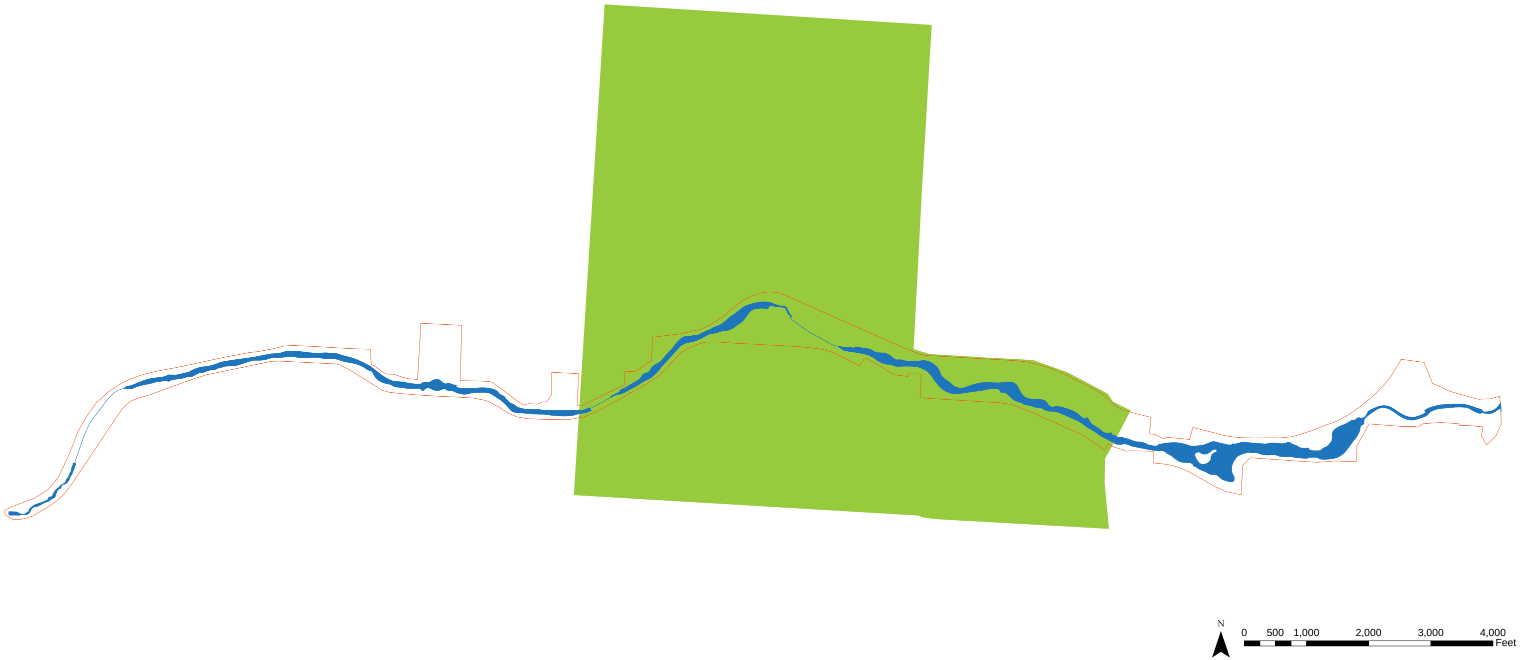


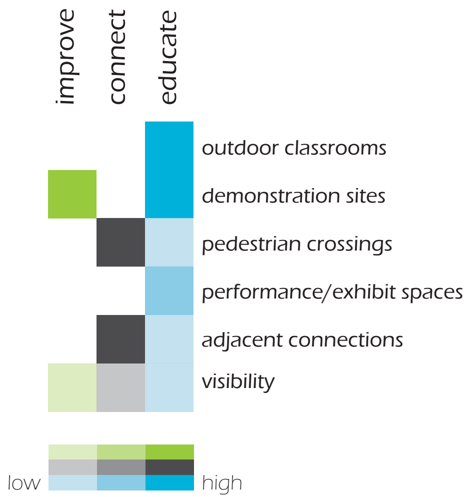
figure 7.11: green impact zone (adapted from MARC)

educate suitability study
schools

Schools present a unique opportunity for community education. Along with being educational institutions, schools also act as educational nodes for the surrounding communities. Schools can have a direct relationship with the Brush Creek Corridor in terms of environmental education. If there are community workshops or programs addressing environmental concerns, public or private schools can use the opportunity to conduct applied environmental science and research in an outdoor venue provided by the corridor. Environmental curriculums can promote field research and applied hands on learning in the corridor.

Schools with a close physical relationship to the corridor will have a stronger relationship and have more opportunities to use the site. For this reason, elementary, middle, and high schools are shown with a quarter mile buffer. Universities, which have a larger area of influence, are shown with a half mile buffer.

factors of influence



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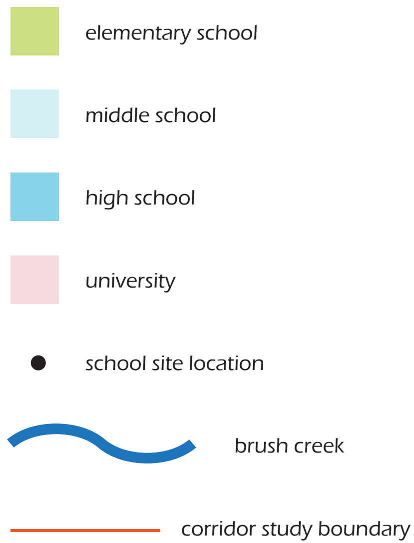


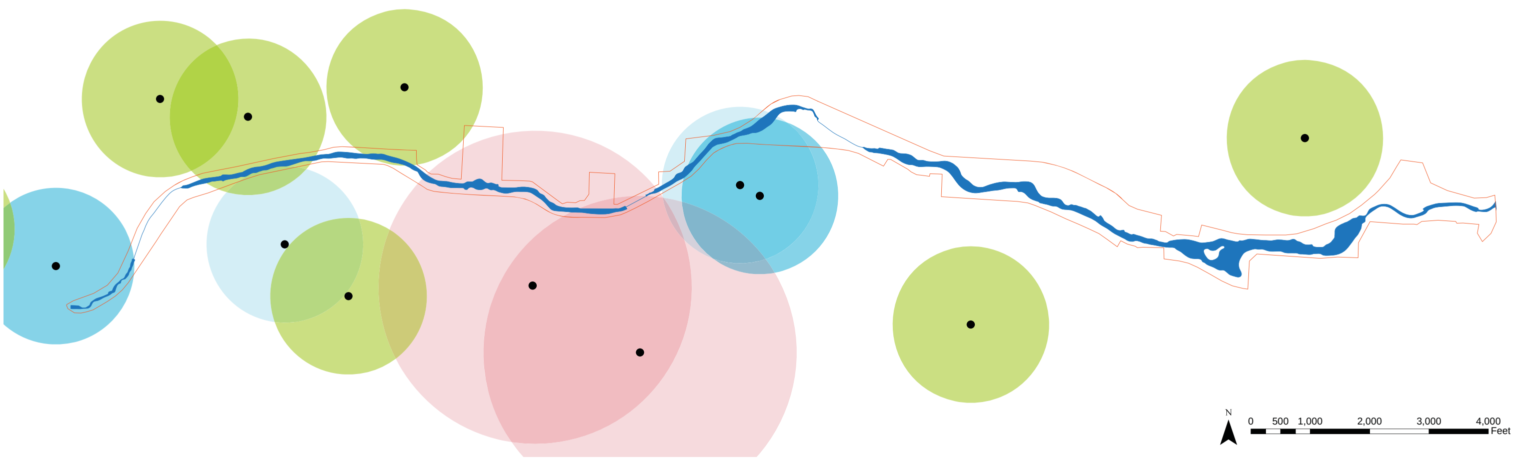


figure 7.12: schools (adapted from MARC)

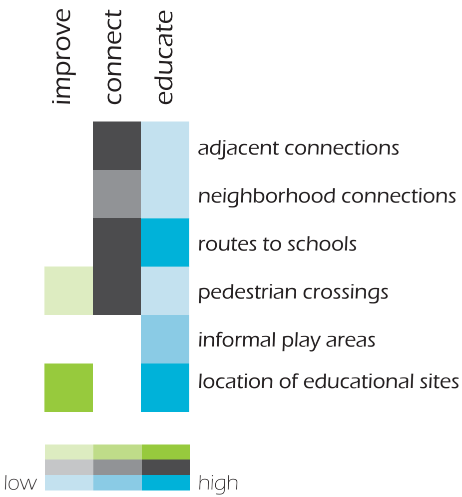
educate suitability study
population

Locating density and distribution of population is important in identifying opportunities to connect the local community to educational opportunities. The age group between 5 and 17 has been specifically identified as the target audience for these opportunities. By determining the locations of highest densities of this demographic, key sites can be identified to directly relate education to the community youth.

Age demographics of a neighborhood or block may change over time as the community ages but based on the land uses and zoning along the corridor, the age distributions should remain relatively the same.

The ability to identify populations of the local youth could lead to implementation of youth oriented spaces and potential linkages between destinations such as schools and residential areas.

factors of influence



legend

- 240 - 400 people age 5 - 17
- 170 - 239 people age 5 - 17
- 90 - 169 people age 5 - 17
- 40 - 89 people age 5 - 17
- 0 - 39 people age 5 - 17
- brush creek
- corridor study boundary

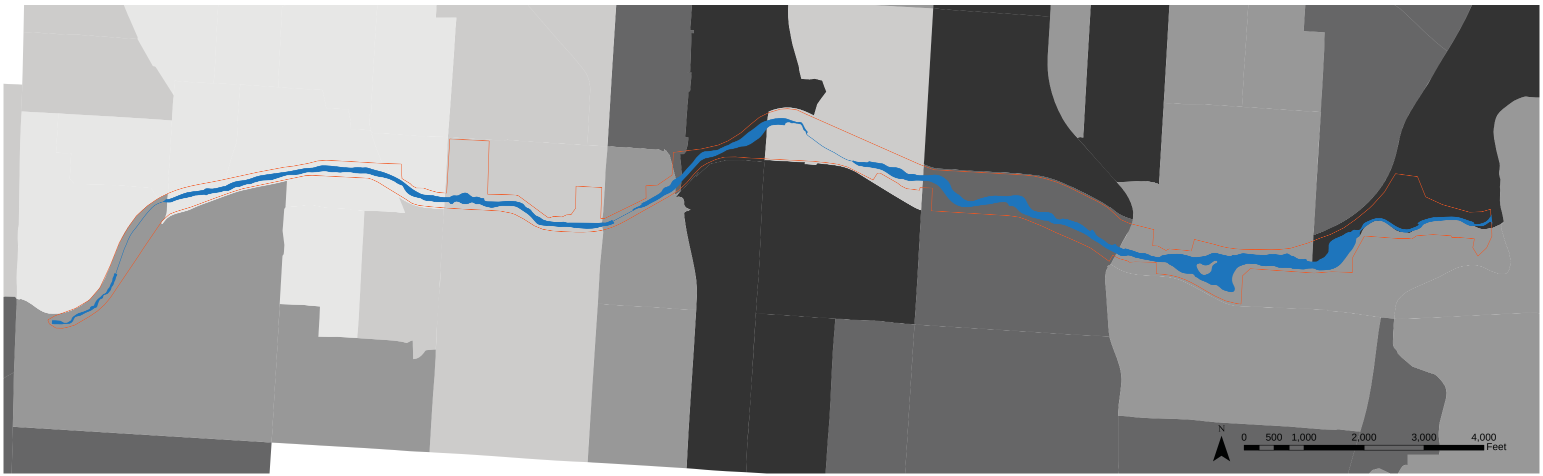


figure 7.13: population - ages 5-17 (adapted from MARC)

glossary

Aggradation (stream channel process): the accumulation of bed materials. (Gordon 2004, 53)

Bank: the margins of a channel. (City of Los Angeles 2007, G1)

Bankfull Width: identified by scour lines, vegetation limits, changes between bed and bank materials, and the presence of flood-deposited silt or abrupt changes in slope. (Gordon 2004, 88)

Base Level: in a stream system, this represents the lowest elevation, such as sea level, controlling downcutting. (Marsh 2005, 416)

Baseflow: the volume of water representing the groundwater contribution (Gordon 2004, 66)

Bed Morphology: the result of adjustments in sediment transport processes to obtain a stable roughness configuration. (Niezgoda and Johnson 2005, 583)

Bioengineering: an applied science that combines structural, biological, and ecological concepts to construct living structures for erosion, sediment, and flood control. It is always based on sound engineering practices integrated with ecological principles. (City of Los Angeles 2007, G1)

Buffer: the zone around the perimeter of a system where land use activities are limited in order to protect the features. (Marsh 2005, 417)

Channel: an open conduit either naturally or artificially created which periodically or continuously contains moving water. (City of Los Angeles 2007, G1)

Channel Pattern: the pattern of a stream when seen in a planimetric view which can be described as straight, meandering, or braided forms, and will also exhibit specific geometric relationships that may be quantitatively defined through measurements of meander wavelength, radius of curvature, amplitude, and belt width. (Rosgen 1996, 2-5)

Classification: the ordering of objects into sets on the basis of their similarities or their relationships. (Rosgen 1996, 3-1)

Confluence: the meeting of two or more bodies of water; usually refers to the point where a tributary joins a larger river. (City of Los Angeles 2007, G1)

Cribwalls (stream bank restoration): a structure containing layers of logs filled with dirt, rock, and cuttings so it can support vegetation. (Riley 1998, 390)

Degradation (environmental process): a process through which the natural environment is compromised in some way, reducing biological diversity and the general health of the environment. (What is Environmental Degradation 2010)

Degradation (stream channel process): the downcutting of a stream into its bed materials. (Gordon 2004, 53)

Deposition: The process of sediment falling out of the water onto the stream bed in areas of lower flow and energy. (City of Los Angeles 2007, G2)

Dynamically Stable Stream Channel: "a channel that has an appropriate channel cross-section to transport sediment during normal flow conditions,; however, it is designed to adjust laterally within this basic form in response to large flows in order to minimize hard stabilization and maintenance." (Rhodeside & Harwell Incorporated 2006)

Ecosystem: a dynamic complex of plant, animal, and micro-organism communities and their non-living environment, linked together through nutrient cycling and energy flow and interacting as a functional unit. (City of Los Angeles 2007, G2)

Erosion: The removal of rock debris by an agency such as moving water, wind, or glaciers; generally, the sculpting or wearing down of the land by erosional agents. (Marsh 2005, 418)

Fill (stream channel process): sediment deposition that occurs as flood waters subside. (Niezgoda and Johnson 2005, 584)

Flood: An overflow or inundation that comes from a river. (City of Los Angeles 2007, G2)

Flood Prone: areas, structures, or infrastructure that is subject to inundation during any high flow period.

Floodplain: the lowland that borders a river, usually dry but subject to flooding. (City of Los Angeles 2007, G2)

Gabion (stream bank restoration): wire cages filled with rock and placed on the water side of stream banks to protect the area from erosion. (Riley 1998, 385)

Habitat: the local environment of an organism from which it gains its resources. (Marsh 2005, 420)

Hardscapes: roads, parking lots, sidewalks, driveways, paved paths, rooftops, and other impervious surfaces that prevent rainwater from filtering through soil and replenishing rivers and streams as groundwater. (Leccese, McCormick and Otto 2004, 75)

Hydraulic Geometry: relates the channel geometry (form) to a selected water discharge at a cross section or in the downstream direction. (Niezgoda and Johnson 2005, 582)

Hypernature: hyper or exaggerated nature expressed in design so that the viewer really understands concept. (Amidon 2003, 58)

Improvement: a change or addition that improves, or that makes the previous condition in some manner better. (City of Los Angeles 2007, G3)

Integrated Planning: allows for the formation of open dialogue and mutual objectives in the collection, sharing, analysis, and presentation of data. (Brown 2006, 9)

Jack (stream bank restoration): steal structures, resembling the children's play toy, that have the ability to grab soil and interlock to provide bank toe stability. (Riley 1998, 384-385)

Lunker (stream bank restoration): boxy structures made of boards and rebar and are often helpful in bank stabilization projects that emphasize improvement of fish habitat. (Riley 1998, 385)

Meander: the winding of a stream channel. (City of Los Angeles 2007, G4)

Mitigation Options: include project specific mitigation, multiple project mitigation, ecosystem based mitigation agreements. (Brown 2006, 32)

Open Space: an area of land that is valued for natural processes and wildlife, for agricultural production, for active and passive recreation, and/or for providing other public benefits. (City of Los Angeles 2007, G4)
Opportunity – a favorable or advantageous circumstance or combination of circumstances. (City of Los Angeles 2007, G4)

Performance Measures: provide a quantitative basis for evaluating actions related to a specific project. (Brown 2006, 45)

Restoration: A return to a condition that represents or reconstructs an original form. In case of natural systems and landscape features, this is includes but is not limited to: the addition or modification of plant and wildlife habitat to create a more natural state. (City of Los Angeles 2007, G4)

Revitalize: to bring new life or vigor to; to restore to a better state; to refresh or renew. (City of Los Angeles 2007, G4)

Riffle-Pool: A portion of a river or stream that alternates between relatively shallow and deeper water. Riffles describe shallow water where the flow is rippling over gravel deposits or boulders, with pools being deeper and calmer water. (City of Los Angeles 2007, G4)

Riparian: A reference to the environment along the banks of a stream; often more broadly applied to the larger lowland corridor on the stream valley floor. (Marsh 2005, 425)

Rock Work (stream bank restoration): hand laid rock wall or unset rocks deposited along the banks. (Riley 1998, 388)

Scour (stream channel process): the local movement of bed material during the rising stages of a flood. (Niezgoda and Johnson 2005, 584)

Stable channel: a channel that does not exhibit progressive changes in slope, shape or dimensions, although short-term variations may occur during floods. (Gordon 2004, 53)

Stream classification (geomorphic form and pattern): a means of typifying a stream based on various boundary parameters, including entrenchment ration, width-depth ratio, sinuosity, water surface slope, and median material size. (Rosgen 1996, 3-5)

Stream Reach: a section of a stream exhibiting similar qualities and physical characteristics.

Suitable: a product addressing a range of desired outcomes from input information.

Sustainability: to keep in existence; to maintain; to supply with necessities or nourishment. Continued viability – whether from an economic or environmental standpoint, while minimizing consumption of resources. (City of Los Angeles 2007, G5)

Vulnerable: the product of a combination of circumstances related to a host of issues which include living with risks and hazards. (Environmental Vulnerability 2010)

Watershed: The topographic divide separating one drainage basin from another. A watershed may be defined as the area within which natural drainage patterns convey surface water flows to a specific low-point destination. (City of Los Angeles 2007, G5)

Wetland: Land with a wet, spongy soil, where the water table is at or above the land surface for at least part of the year. (City of Los Angeles 2007, G5)

glossary

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