Red Butte Creek at the Williams Building

LANDSCAPE LAB

THE UNIVERSITY OF UTAH

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SECTION 01

INTRODUCTION TO LANDSCAPE LAB

The Williams Building is located in the University of Utah Research Park at the mouth of Red Butte Canyon.

The Williams Building, located along a key urban/wildland interface at the mouth of Red Butte Canyon, presents a unique opportunity to introduce a new type of landscape to the University of Utah campus, and to explore possibilities for integrating Red Butte Creek into campus life. The northern end of the site is located at the intersection of Red Butte Creek and the Bonneville Shoreline Trail (BST), increasing its visibility and potential value as a connection between the University and the regional trail network.

Through a participatory design process involving designers, researchers, and campus planners, the Landscape Lab intends to increase the visibility of Red Butte Creek and to create a beautiful, more sustainable, and inviting place along the waterway. **The project marks a significant first step in larger efforts to rehabilitate the Red Butte Creek watershed,** including those currently in planning by the University and community groups.

The lower Red Butte Creek watershed is one of the most urbanized of the four creeks that flow through Salt Lake City's boundaries, and restoration at the Williams Building reach can have multiple positive impacts. At the same time, good design with thoughtfully integrated ecosystem services at the Landscape Lab may catalyze ecologically-sound interventions and restoration efforts throughout the Red Butte Creek sub-watershed.

The project includes hands-on environmental education and ongoing research opportunities, design strategies for capturing and treating stormwater runoff, and a significant reduction of irrigation water use in the landscape.

PROJECT OBJECTIVES

CONNECT

» Connect site users to creek
» Connect to trail network (existing + future)
» Provide safe creek access
» Create recreational opportunities

EDUCATE

» Maximize educational opportunities (formal + informal)
» Create experiments / Research opportunities (data collection)
» Provide a case study for future projects

ENLIVEN

» Create a destination for humans and non-humans
» Reduce erosion & site run-off
» Increase on-site infiltration
» Reduce irrigation water consumption
» Improve environmental quality

GREEN INFRASTRUCTURE

Green infrastructure incorporates ecosystem services (such as storm water remediation) into the urban landscape by supplementing or replacing existing built infrastructure (e.g. storm drains and storm water sewers) with living systems.

These systems provide cooling, beauty, and amenity value while improving environmental quality and infrastructure resilience, at lower cost than traditional, built infrastructure.

Landscape Lab will serve as a demonstration project for green infrastructure locally and regionally, and provide valuable performance data to support future projects.

The project is a garden-laboratory, where ideas can be tested and outcomes assessed, all while providing opportunities for both active and passive recreation that create an immersive, restorative ecological experience.

At the same time, Landscape Lab will reveal and celebrate ecological processes, the human place in nature, and provide opportunities for education in multiple forms.

SECTION 02

DESIGN METHODOLOGY

The design team employed a systems approach to the opportunities and challenges presented by the existing Williams Building landscape, and used research questions as building blocks to achieve project goals. The team endeavored to create a framework with the flexibility to accommodate changing research and educational needs over time.

PARTICIPATORY DESIGN PROCESS

The project was conceived of as an effort to bring the knowledge contained within multiple research disciplines at the University of Utah into the built environment through stakeholder input. University faculty, staff, and students representing Ecological Planning, Geology, Ecology, Parks, Recreation and Tourism, City and Metropolitan Planning, Civil and Environmental Engineering, the Center for Sustainability Resources, Campus Planning, Red Butte Garden, Facilities Management, and Real Estate Administration all participated in initial site exploration, problem definition, programming, and evaluating proposed solutions. In addition, watershed planners with Salt Lake County and Salt Lake City provided valuable insights in solution evaluation.

DESIGNED EXPERIMENTS

A key part of the participatory design process is the team's approach to the site as a "designed experiment," which incorporates ecological research hypotheses into the design of urban landscapes. An emerging area of research, designed experiments create a conversation between ecologists and designers regarding the formation of research questions, choosing of sites, configuration of treatment approaches, and planning of measurements and statistical tests.

PARTICIPATORY DESIGN

Participatory design is an approach that attempts to actively involve all stakeholders (e.g. employees, partners, customers, citizens, end users) in the design process to help ensure the result meets their needs and is functional.

In participatory design, participants are invited to collaborate with designers, researchers and developers during an innovation process.

Potentially, they participate during several stages of a design process:

- » initial exploration;
- » problem definition;
- » development; and
- » solution evaluation.

Through the participatory design process, researchers provided input to the design team regarding both ecologic and social criteria to be analyzed and evaluated at the Landscape Lab. The design team then collaborated with researchers to determine the ways in which this criteria could be implemented in the built environment. It is hoped that data gathered from the designed experiment can be applied to future interventions within the lower Red Butte Creek watershed.

The process began first by clarifying objectives and then creating a number of research questions, which the team whittled down over time in order to develop a feasible landscape master plan which would meet project and stakeholder objectives. Many of these questions, however, are relevant to sites along Red Butte Creek throughout the University of Utah campus, and are thus included here for consideration in future projects.

RESEARCH QUESTIONS

The design committee posed several research questions that could be explored in the design of the Landscape Lab at the Williams Building. The committee also advocated a flexible approach that could accommodate changing research goals and new technologies for future research.

Suggested research questions posed fell into four general categories:

1. water flows;
2. flora;
3. fauna; and
4. human/landscape interaction.

WATER FLOWS

» How can we minimize water consumption and improve water quality in a measurable way that also allows us to determine unintended consequences?

» Do landscape elements designed to reduce runoff and increase infiltration work as intended?

» Do "low-water use" design elements actually use less water?

» Which green infrastructure techniques perform best in arid climates?

» How will carbon and nitrogen (currently stored in the soil) destabilized by the new landscape design impact the creek? How significant will these impacts be?

» The assumption is that fertilizer and pesticide application harms the creek. How do landscape changes alter this? Are there measurable improvements?

» Is the site too small to measure changes in hydrology? Can we instrument outfalls above and below the project site? What about flows specifically from the rooftop?

» Can changing the sub-surface and overland flow have an impact on the stability of the bank and the rate of slope failure?

» Can we address bank and channel issues with this project?

HUMAN INTERACTION

» How does food production work in tandem with green infrastructure?

» What are energy use implications of the goals of this project?

» How do different features and amenities influence different connections with the environment?

» Can we do a before/after survey of building occupants who are regularly using (or at least proximate to) the space?

FLORA

» Which plants are the most effective in terms of root mass for erosion control?

» What are the differences over time between a plant bed started with 1-5 gallon plants versus tubelings?

» Does a design intended to create habitat for a particular species of bird or animal actually attract that species?

» Which planted species are the most successful on site, and which volunteer species emerge and do well? Which species fail?

» How should we monitor invasive species?

» Is root depth the critical element in plant water use?

» Why are existing trees on site failing? Should they be replaced and the new trees studied?

» What are impacts of new irrigation regime on the existing trees?

» What plant species do well with varying amounts of supplemental irrigation?

» Can we test methods of preserving the existing trees?

» How much green infrastructure do we need to implement (at what scale) to see a measurable change in the creek?

» What are the processes at play with the soil and vegetation?

FAUNA

» Can we try to attract pollinators to create research opportunities? Perhaps existing Utah State University research on pollinators at Red Butte Garden could be expanded?

» Are there integrated-pest management solutions for annual box elder bug infestations we can evaluate?

» What are the impacts of changing landscapes on wildlife prevalence, diversity, etc.?

DESIGN SOLUTIONS

CONNECT (*HUMAN INTERACTION*)

Meadow landscape

Goals for people revolved around connections; both connections between destinations as well as a larger sense of connection to place. To accomplish this, the team created places to rest, recreate, discover, and educate, along with places to visually access the deeply incised creek. Physical access was located where feasible along the creeks deeply incised banks, but designed to remain inconspicous in order to balance research needs with stream health. Visual access to the creek was strengthened by the inclusion of a bridge from the site to Cottam's Grove.

ENLIVEN (*FLORA* + *FAUNA*)

Plants were selected to increase biodiversity on the site, filter storm water runoff, and to reduce the need for both water and fertilizer in the landscape. Aesthetic goals for plants included creating a meadow landscape with multiple colors and long blooming seasons that would inspire exploration and delight. Goals relating to animals included increasing habitat value for birds and insects, pollinators in particular. Places of pause, including areas with shade and seating, were included in the design both to maximize plant water uptake during the hot summer months, and to encourage visitors to the Landscape Lab to stay and take in their surroundings.

EDUCATE (*WATER FLOWS*)

Bioswale

The design of water flows on site uses green infrastructure techniques to slow water flows into Red Butte Creek, increase groundwater recharge, filter pollutants from stormwater runoff, harvest runoff for plant use, and to reduce irrigation water use. To accomplish this, a series of connected bioswales was designed to lead downslope from the lower parking lot to Chipeta Way. The the water flows are engineered to treat parking lot runoff is treated separately from roof runoff in the bioswales. Additionally, two types of bioswales were engineered, one to promote infiltration, and the other to retain water for plant use. Both the design and signage will explain the purpose and function of the bioswales. Additionally, the two types of bioswales will provide a test and control for researchers exploring multiple hypotheses.

SITE ANALYSIS

SECTION 03

BUILT ENVIRONMENT

LOCATION

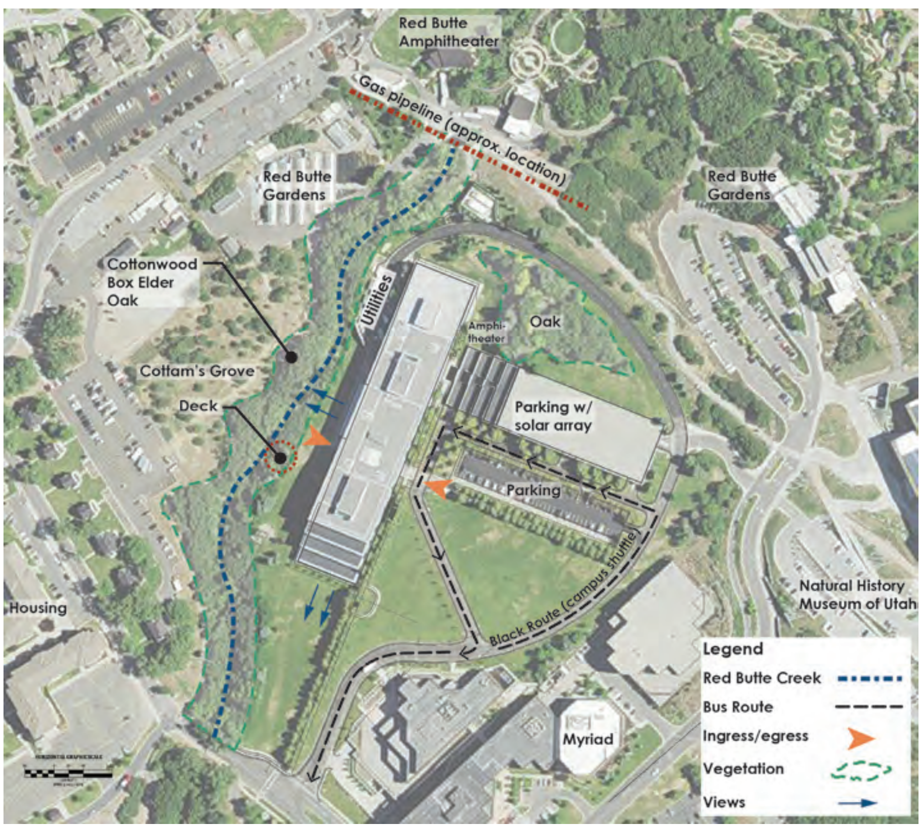
The Williams Building site is located at the mouth of Red Butte Canyon, an important urban/wildland interface in Salt Lake City. The site is roughly 17 acres in size. Red Butte Creek flows along the parcel's western edge, Chipeta Way runs along its southern boundary, and an access road runs to the east and north.

Located on the northern edge of the University of Utah Research Park, the parcel sits at the intersection of multiple land uses—student housing, office buildings, the Red Butte Garden Amphitheater, the Bonneville Shoreline Trail (BST), Red Butte Garden Visitor Center and botanic gardens, and the Museum of Natural History.

Connection from creek to BST

Southern edge of site

Chipeta Way



Williams Building Site Map

CONNECTIONS

The southern end of the site is bounded by Chipeta Way, and the northern end intersects the Bonneville Shoreline Trail. The 2011 University of Utah Bicycle Master Plan recommends the creation of a bikeway along Chipeta Way and a shared use path along the Red Butte Creek reach just south of Chipeta Way. The creek is piped below ground and flows to the east of the intersection of Pollock Road and Chipeta Way, which creates a challenge in terms of relating the new trail to the existing sidewalk network.

These existing and proposed connections create opportunities to ensure that the Landscape Lab's connections to its surroundings that are visibile and legible to pedestrians and bicyclists.

CIRCULATION

The existing circulation pattern at the Williams Building site is designed for vehicles, with an access road from Chipeta Way that circles the east side of the property, and entrances to a parking lot and parking structure to the east of the building. There is a little-used pedestrian walkway which leads from the crosswalk on Chipeta Way.

In addition to use by Williams Building occupants, the adjacent parking garage is utilized in the summer months for events at the Red Butte Amphitheater, and overflow parking for the nearby garden and museum. Currently there is no direct path to the amphitheater from the garage, and visitors generally walk in the access road up to the Bonneville Shoreline Trail.

A University of Utah campus shuttle stops at the Williams Building, and runs weekdays every 15 minutes between 6:00 a.m. and 6:00 p.m. during the spring and fall semesters.

VIEWS

Long views from the site are primarily to the east, south, and west, including the Wasatch Range to the east, and the Oquirrh Mountains to the west. The site plan does not take advantage of these views, as it privileges arrival at the building by car, and not attention to the surrounding landscape.

Any changes to landscape should be sensitive to views from the building to the south and west. Tall trees should be avoided, and any improvements should frame and enhance views by screening foreground while leaving the long views clear.

View to northeast

View to south

2010 OIL SPILL

In June 2010 there was a break in a Chevron crude oil pipeline that runs along the site's northwestern boundary (near the creek's intersection with the Bonneville Shoreline Trail) that leaked approximately 800 barrels (34,000 gallons) of crude oil; 400 barrels of which entered directly into Red Butte Creek (RBC).[1] Clean up activities began shortly after the spill was detected, and continued for more than three months.

RBC oil spill clean-up

In December 2010, however, a second spill released more than 500 barrels (21,000 gallons) of crude oil from the same pipeline, which was located approximately 500 feet from the site of the June oil spill.[2] As noted in the University of Utah's Red Butte Creek Strategic Vision document:

RBC oil spill clean-up

> The Utah Division of Water Quality (DWQ) issued a final closure document in 2012, declaring the spill cleanup a success: "no further cleanup is needed…traces of contamination remaining in the creek are not a threat to human health or the environment." The results of continued DWQ monitoring, scheduled through 2015, are not publicly available.[3]

OTHER CONTAMINANTS

A survey conducted in fall 2015 did not find contaminants in the soil at the proposed Red Butte Garden Horticultural Compound, which is located on the west bank of Red Butte Creek, directly across from the Williams Building.[4]

1 Utah Department of Environmental Quality, *Red Butte Creek Screening Level Ecological Risk Assessment - Final*, November 2012. Accessed online at http://www.deq.utah.gov/locations/R/redbutte/docs/2012/11Nov/RBC_SLERAFinal110712.PDF on 11/19/2105

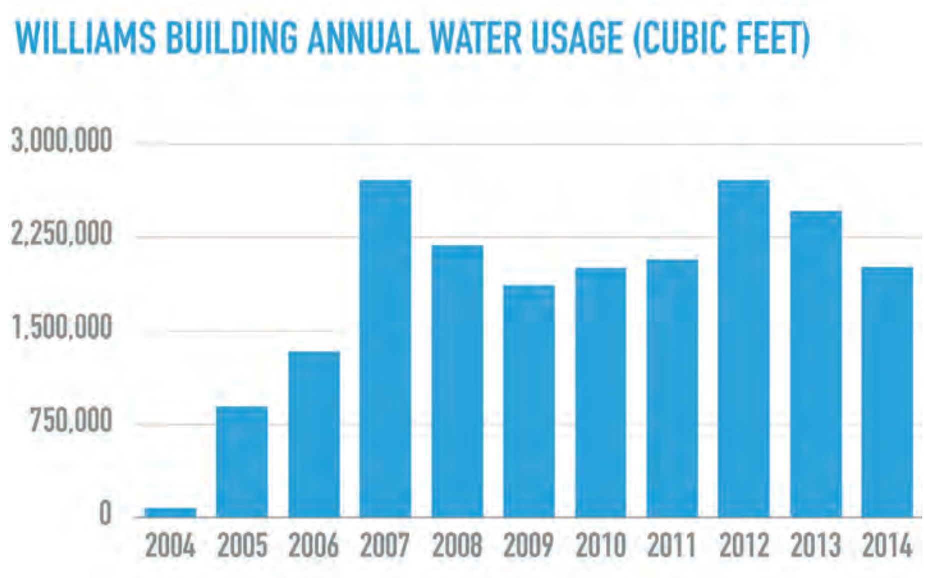
2 Carbaugh Associates and VODA Landscape + Planning, *Salt Lake City 2010 Red Butte Oil Spill Work Group Report*, p. 46.

3 DRAFT *University of Utah Red Butte Creek Strategic Vision,* 10/12/2015.

4 EarthFax Engineering Group, *Red Butte Gardens Proposed Horticultural Compound Soil Vapor*

IRRIGATION WATER CONSUMPTION

The majority of the landscape at the Williams Building is maintained as turf grass, which requires extensive irrigation. Water use records extending back to 2001 demonstrate that the amount of water used on the site has increased steadily. Currently, the building uses an average of 2.4 million cubic feet of irrigation water annually.



Williams Building annual water use, 2004 – 2014

A prime objective of the project is to create a more environmentally sustainable site that requires fewer resources of time and expense. Using more efficient irrigation techniques and technology could significantly reduce the amount of water and resources needed to maintain the site. Smart controllers and a more customizable system for the irrigation of the site will also allow for a more methodical analysis of the site's water consumption.

Survey - Summary Report, November 2015.

NATURAL SYSTEMS

RED BUTTE CREEK

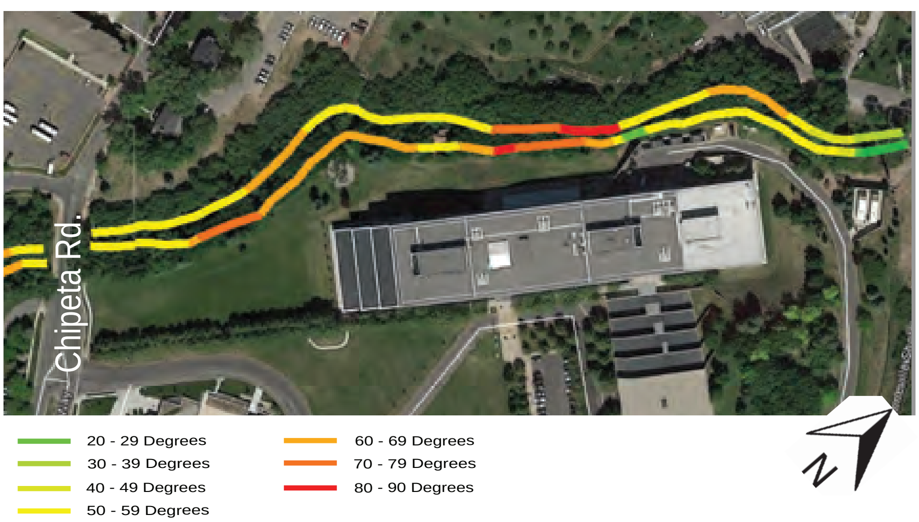
Red Butte Creek's watershed is made up of two sub-watersheds with decidedly different land use characteristics. The upper sub-watershed, above the reservoir, runs through the Red Butte Canyon Research Natural Area, and has been protected by the federal government for over a century. The stretch of Red Butte Creek that runs along the Williams Building, however, sits within the lower sub-watershed and has become increasingly urbanized and paved over within the same time frame.

Comparison of aerial photography from 1977 and 2014 reveal that the path of vegetation along the creek (and by inference, the Creek's meander) has remained consistent over the past four decades. In contrast, there has been a marked increase in the amount of impervious surface within the watershed in that time. Where Red Butte Creek runs through the University of Utah campus, it functions mainly as a channel for stormwater, negatively impacting both the hydrologic and ecologic functions of the creek.

The majority of the stream banks of the Red Butte Creek are deeply incised as it runs along the boundary of the Williams Building site, with bank angles that range from 50 – 90 degrees along most of its length, with the exception of a shallower slope (+/- 20 degrees) at the northern part of the property, near the location of the 2010 Chevron pipeline spills.

Williams Building Site, 1977

Williams Building Site, 2014



Streambank angle (Graphic from Nathan Anderson, Red Butte Creek Geomorphology, *University of Utah Global Change and Sustainability Center, 2015).*

SOILS

The parent soils on the site are typically very well drained, and the topsoil generally consists of average, loamy soils. It is likely that (unknown) fill material sits between the topsoil (which is six inches deep, on average) and the parent soil.

The USDA classifies all soil to the east and due south of the building as Timpanogos sandy loam, with slopes of 6 to 10%, while the soils along the creek are more generically classified as stony terrace escarpments. According to the USDA soils series description, Timpanogos soils are: "Very deep, well drained soils that formed in lake sediments derived from quartz, limestone, sandstone, gneiss, and granite. Timpanogos soils are on lake terraces and have slopes of 0 to 40 percent."

As a class 3e soil, Timpanogos sandy loam has "severe limitations that reduce the choice of plants or require special conservation practices, or both." In addition, *"susceptibility to erosion [and past erosion damage are] the dominant problem or hazard affecting [its] use."*[5]

Along the creek, stony terrace escarpments consists of stratified soils ranging from sandy loam to clay loam. "Stones and cobblestones make up 40 to 70% of the volume in most places.... Runoff is medium to rapid, and the hazard of erosion is high."[6]

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5 National Soil Survey Handbook (NHHS) Part 622: Interpretative Groups. Emphasis added. Accessed online on 11/10/15 at http://www.nrcs.usda.gov

6 Woodward et al., Soil Survey of Salt Lake Area, Utah, 1974, USDA Soil Conservation Service.

TIMPANOGOS SANDY LOAM

Typical soil profile:

- Ap - 0 to 7 inches: sandy loam
- B21t - 7 to 13 inches: loam
- B22t - 13 to 18 inches: loam
- C1 - 18 to 27 inches: loam
- C1ca - 27 to 39 inches: sandy loam
- C3ca - 39 to 60 inches: sandy loam

Depth to restrictive feature:
More than 80 inches

Natural drainage class:
Well drained

Capacity of the most limiting layer to transmit water (Ksat):
Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table:
More than 80 inches

Frequency of flooding:
None

Frequency of ponding:
None

Calcium carbonate, maximum in profile:
30 percent

Salinity, maximum in profile:
Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water storage in profile:
Moderate (about 7.2 in)

Interpretive groups:

Land capability classification (irrigated & nonirrigated): 3e

Hydrologic Soil Group: B[1]

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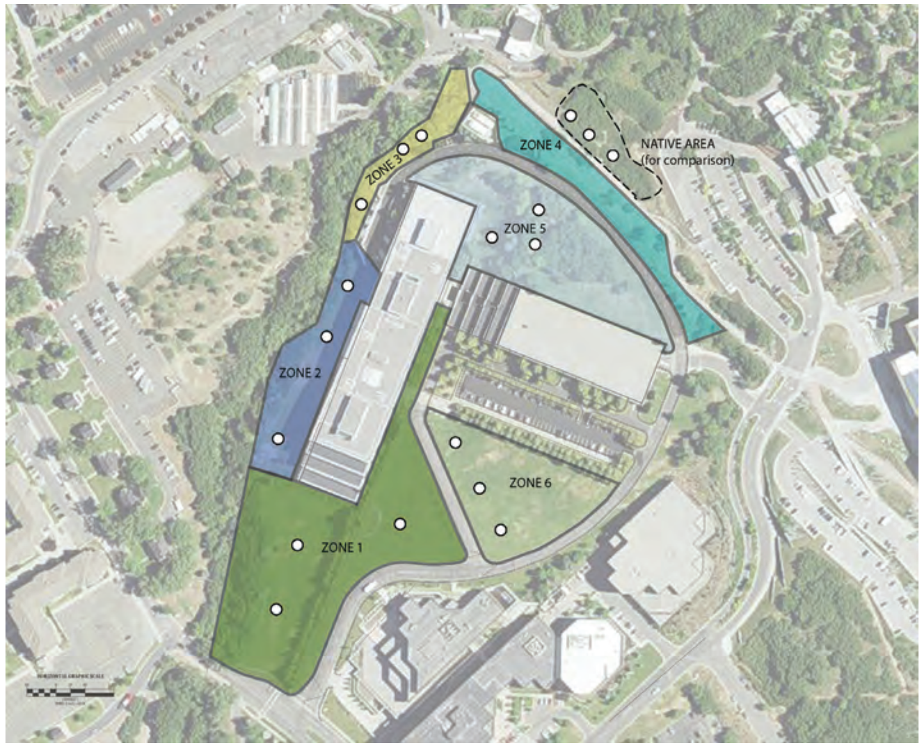
1 http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx, accessed on 10/23/15



TOPSOIL ANALYSIS RESULTS

Topsoil analysis was performed in January 2016. Three samples were taken from different areas in each of the six zones shown on the map above. The three samples were then combined to provide a subsample representative of the entire zone.

In four of the six zones tested, the topsoil was ***sandy clay loam***. In zone 5 (the oak grove) the soil was loam, as was the soil sampled in the comparison native area.

All zones had coarse fragments (rocks) that were greater than acceptable levels according to topsoil quality guidelines; zones one, three, and five had coarse fragments larger than 1.5" in diameter.

All zones had insufficient nitrogen and phosphorous levels. (Potassium and iron met nutrient specifications.)

Subsoils were reached at between five and eight inch depths in all areas, and on visual inspection appeared generally clayey and hard.

Recommendations for maintenance:

- When using waterwise plant species, apply a Nitrogen Phosphorous fertilizer at half the label rate every other year.
- For turf or non-waterwise species, apply Nitrogen Phosphorous fertilizer at the label rate every year (note this may include multiple applications over the course of a season).

» Existing organic matter content is suitable for semi-desert, foothill, and mountain plant communities.

» Existing organic matter content is unsuitable for desert plant species.

» Where feasible, screen zones one, three, and five to remove coarse fragments larger than 1.5" in diameter.

TOPOGRAPHY

The site slopes roughly 10% from north to south, with an elevation change of 138 feet between the two ends of the property.

FLOOD ZONES

The only portion of the property in the FEMA flood plain is an area of approximately 0.1 acres at the southwest portion of the property where Red Butte Creek abuts Chipeta Way.

EXISTING VEGETATION

View to linden trees through redbud trees

Dense vegetation along creek corridor

The vast majority of the property is covered in turf grass. There is a double row of linden (*Tillia x europaea)* trees along the walkway that leads to the building from Chipeta Way. A mature gambel oak (*Quercus gambelii*) stand is located in the northern portion of the site, while some younger lindens and redbud trees are planted adjacent to the building and parking structure.

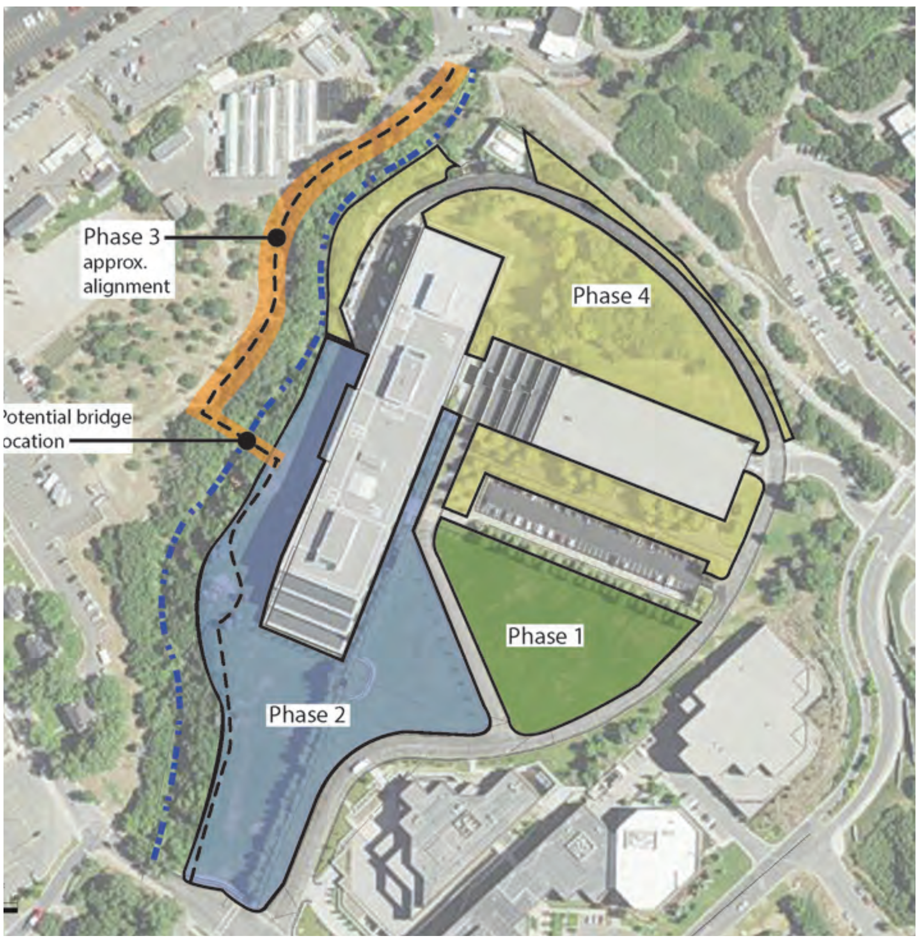
Along Red Butte Creek, canopy species noted were gambel oaks (*Quercus gambelii*), box elder (*Acer negundo*), Narrowleaf cottonwood (*Populus angustifolia*), along with the invasive Russian olive (*Elaeagnus angustifolia*). Shrub species include redosier dogwood (*Cornus sericea*), creeping barberry (*Mahonia repens*) and willow (*Salix spp*.)

Understory species observed include Western aster (*Symphyotrichum ascendens*), Western poison ivy (*Toxicodendron rydbergii*), Virginia creeper (*Parthenocissus quinquefolia*) and the invasive lesser burdock (*Arctium minus*).

There are also coniferous trees planted along the western portion of the site, adjacent to the creek.

PROJECT PHASES

SECTION 04



This master plan allows for a phased approach to establishing the site as "Landscape Lab." The steering committee has prioritized the site into four phases over the next few years. These phases will be implemented as resources and funding are identified.

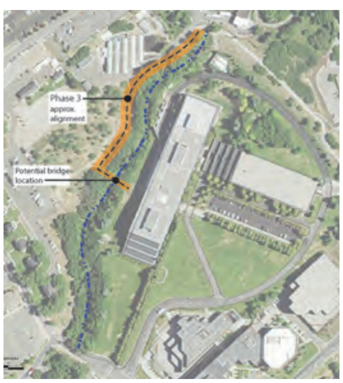
LANDSCAPE LAB PROJECT PHASING

Phase 1:

- » new visitor parking lot slated for construction in 2016.
- » bioswales will treat stormwater runoff from both parking lots.
- » paths will allow access through area from adjacent buildings.

Phase 2:

- » bioswales will treat runoff from roof areas.
- » First phase of trail will lead to outdoor classroom and/or dining area ajacent to building, and accomodate connection with bridge in phase 3.
- » this area will include a limited amount of turf to accomodate outdoor activities, and to serve as a control for designed experiments.



Phase 3:

- » bridge across Red Butte Creek will allow for visual access to creek.
- » trail will run along tree line at the edge of the riparian buffer zone.
- » trail through Cottam's Grove area will connect to BST near amphitheater.

Phase 4:

- » majority of turf will be replaced with waterwise vegetation.
- » existing parking lot vegetation will be replaced with waterwise species.
- » designed experiment will be developed for gambel oak grove.
- » access to Red Butte Creek will be available (primarily to researchers).

View to east. Myriad Genetics building in midground.

Shuttle route.

DESIGN CONSIDERATIONS

- New parking lot slated for construction in 2016.
- Area needs to accomodate pedestrian traffic between Williams Building and Myriad, other buildings in Research Park.
- Slope is approximately 8 - 10% from new parking lot to street.
- Integration with the rest of the site.

PHASE 1:

EXISTING CONDITIONS

- large expanse of lawn
- double row of linden trees to the north along the parking lot
- pedestrians currently walk on road to get to Williams Building from Myriad
- “Island” of land surrounded by asphalt

PHASE 2:

EXISTING CONDITIONS

- Connection to Red Butte Creek from Chipeta Way
- Large expanse of lawn
- Pedestrian entry to building
- Allee of linden trees along walkway
- Newer plantings along building face
- Mixed evergreen and riparian species along Red Butte Creek

View to southeast.

View to Williams Building from Chipeta Way.

DESIGN CONSIDERATIONS

- Largest available space for designed experiments.
- Visibility from main road sets the tone/look & feel of the site.
- What are soil amendment needs?
- What landscape elements will attract people to this area?
- Should this area be primarily visually appealing and used for experiments?

Grass terraces leading from outdoor dining/cafeteria area to creek.

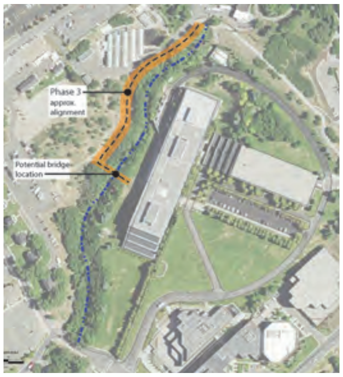
Level expanse of lawn between building and creek.

EXISTING CONDITIONS

- » Connection to Red Butte Creek from Williams Building
- » Large expanse of lawn
- » Views from building, including dining area
- » Mixed evergreen and riparian species along Red Butte Creek
- » Grass terraces are inadequate to mediate building/landscape transition
- » Wood deck over RBC is somewhat hidden by vegetation

DESIGN CONSIDERATIONS

- » Opportunity for improved landscape interface with building.
- » Better connectivity between building and creek corridor.
- » Opportunities for visible stormwater remediation techniques.
- » Opportunities to access Red Butte Creek visually.
- » Opportunities for food production (kitchen gardens).



PHASE 3:

EXISTING CONDITIONS

- » Runs through Cottam's Grove, an area named after a professor of Botany who researched hybrid gambel oaks.
- » Passes by RBG Horticultural Compound
- » Horticultural compound has "housekeeping" items visible, but is undergoing redesign concurrent with this project

Mature gambel oak stand.

DESIGN CONSIDERATIONS

- » Banks of Red Butte Creek are steeply incised and dangerous in areas.
- » Providing privacy for Horticultural Compound.
- » Providing privacy for tour buses at Red Butte Amphitheater.

PHASE 4:

EXISTING CONDITIONS

- large “amphitheater” space
- large existing gambel oak stand incompatible with turf water needs & maintenance
- outdoor space is little used
- Connections to BST and Red Butte Amphitheater

Mature gambel oak stand.

“Amphitheater” space along northeast corner of building

DESIGN CONSIDERATIONS

- large areas available for study/designed experiments.
- Is amphitheater space functional for building occupants?
- Reconsider connections between Williams Building and adjacent destinations.

EXISTING CONDITIONS

- mostly non-public area
- road is used to access Red Butte amphitheater from parking structure
- some mature trees
- lawn area is steep

Interface between BST and Williams Building landscape.

View to east along access road.

DESIGN CONSIDERATIONS

- conversion of steep lawn to low-maintenance, no-mow landscape.
- potential for pedestrian connection to Red Butte Garden entry.
- connection to Red Butte amphitheater.

View of utilities located along buildings northwest corner.

Narrow area of passge between retaining wall and streambanks.

DESIGN CONSIDERATIONS

- retaining issues in need of addressing.
- opportunity to design experience of enclosure.
- safety concerns.
- design to enable access to RBC without creating stress on waterway.

EXISTING CONDITIONS

- narrow point between building utilities & creek
- high elevation above creek through most of this area
- Erosion issues present
- Has a small area where RBC is safely accessible

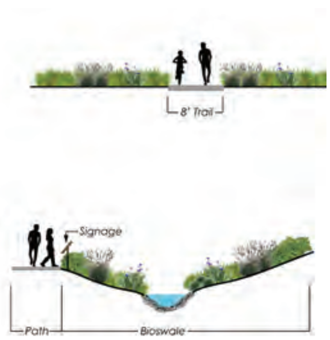
DESIGNED EXPERIMENTS

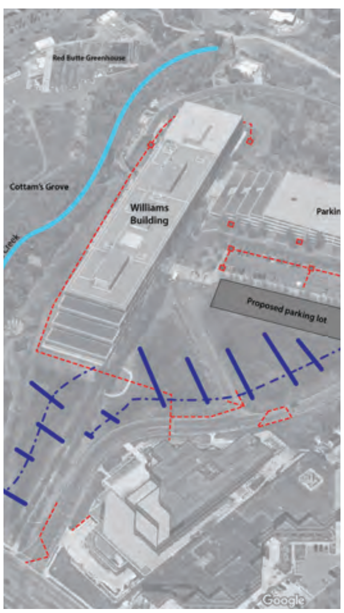
SECTION 05

The process of creating a master landscape plan for Landscape Lab has produced "designed experiments" for various elements on the site. The various systems of the site will need to be monitored in order to produce useful and usable information from the experiements.

The following pages are cut sheets for specific systems on the site and how they could be used for scientific research by University faculty and students. These experiments focus on landscape specific systems: water flows, plant species, irrigation systems, and fauna found on site.

Each of these designed experiments should have a "champion" who coordinates with the Williams Building management and maintenance staff. These experiments should be monitored and tracked over time in order for the site to function as an active research location.





A. METHODOLOGY

- » Storm water runoff flows are directed downslope into a series of connected bioswales. The upper set of bioswales captures and treats parking lot runoff, as well as roof runoff from the parking garage. The lower set of bioswales captures and treats roof runoff from the Williams Building. Bioswale A retains and stores stormwater to provide irrigation to the bioswale plants, while Bioswale B infiltrates stormwater into the groundwater system. The both types of bioswales mitigate stormwater runoff before it flows into Red Butte Creek.

B. RESEARCH QUESTIONS

- » Do landscape elements designed to reduce runoff and increase infiltration work as intended?
- » Which bioswale type (A or B) performs best in Salt Lake City's arid climate?
- » How much runoff is still reaching Red Butte Creek via the outfall pipe during various size precipitation events?

C. DATA TO COLLECT

- » Pre-change water flows in Red Butte Creek, including during and after storm events (use data available from iUtah).
- » Collect data on amount of runoff captured in bioswales during different size storm events; snowmelt runoff captured.
- » Compare runoff collected in lined bioswales vs. unlined bioswales, including different nutrient and chemical composition of the stormwater.

D.. FREQUENCY OF DATA COLLECTION

- » After storm events.
- » During early spring snow melt.
- » Annually.

A. METHODOLOGY

- » Zone test plots within Bioswale A and Bioswale B, and compare the impacts of lined bioswales vs. unlined bioswales on plant growth and survival. Record plant health and determine the need for additional irrigation in both types of bioswales, especially during summer months. In addition, compare the impact of pollutants on plants between the different bioswale types.

B. RESEARCH QUESTIONS

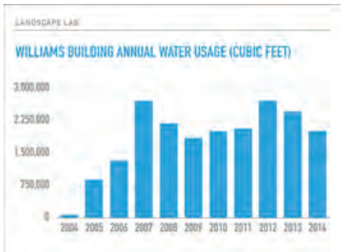
- » Which planted species are the most successful on site, and which volunteer species emerge and do well? Which species fail?
- » What is the impact of water quality on plants fed by parking lot runoff vs. roof runoff on plant communities within the bioswales?

C. DATA TO COLLECT

- » Assess pollutant uptake within plants.
- » Determine which plants are thriving under different water usage regimes.
- » Is root depth the critical element in plant water use?

D. FREQUENCY OF DATA COLLECTION

- » Monthly during growing season.
- » After storm events.



A. METHODOLOGY

- » Bioswales and landscape areas are zoned to receive different amounts of supplemental irrigation. Determine which bioswales and landscape areas retain the most water, and adjust irrigation schedule accordingly. For example, it is assumed that within the "step-pool" system of bioswales, the upslope bioswales will receive more water than those downslope.

B. RESEARCH QUESTIONS

- » Do "low-water use" design elements actually use less water?
- » What are impacts of the new irrigation regime on the existing trees?
- » What plant species do well with varying amounts of supplemental irrigation?

C. DATA TO COLLECT

- » Irrigation water amounts by zone.
- » Amounts of water collected in bioswales during storm events, relative to position on slope.

D. FREQUENCY OF DATA COLLECTION

- » Monthly and after storm events.

A. METHODOLOGY

» Plant a landscape area at the Williams Building to attract a particular species or type of species (pollinators, for example) that lives in the Red Butte Canyon Research Natural Area, and determine if it actually uses that area.

B. RESEARCH QUESTIONS

» Do the design elements attract the desired species? If so, which design elements are most attractive to the desired species?

» What is the physical area of habitat needed to create a viable corridor or patch for wildlife travelling from the Research Natural Area?

» What are the impacts of changing landscapes on wildlife prevalence, diversity, etc.?

C. DATA TO COLLECT

» Location and area of habitat area

» Planted and volunteer plant species in habitat area

» Note which wildlife species visit the designed attractant area

D. FREQUENCY OF DATA COLLECTION

» Monthly during spring through early fall months

A. METHODOLOGY

- The existing roof runoff enters into Red Butte Creek via the high-velocity, underground storm sewer system creates erosion along the banks opposite the pipe outfall. When the Landscape Lab is constructed, the runoff will be diverted into two sets of bioswales which either retain stormwater, or infiltrate it into groundwater.

B. RESEARCH QUESTIONS

- Can changing the sub-surface and overland flow have an impact on the stability of the bank and the rate of slope failure?
- Which locations along the streambanks are impacted by the change in flows?

C. DATA TO COLLECT

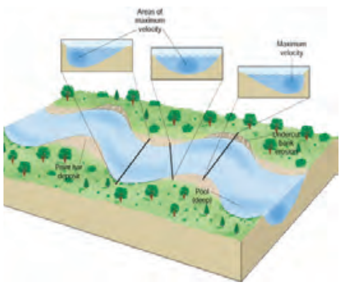
- Pre- and post-construction water volumes
- Pre- and post-construction slope angles near pipe outfall (see *Red Butte Creek Geomorphology*, University of Utah Global Change and Sustainability Center, 2015)

D. FREQUENCY OF DATA COLLECTION

- Twice annually, and after major storm events.

A. METHODOLOGY

- The existing landscape includes fertilizer and pesticide applications intended to maintain green, lush turfgrass, as well as linden, redbud and maple trees. When the existing plants are replaced with diverse meadow plants and a bioswale system intended to filter pollutants from stormwater, this should change the quality of the water being released into the Landscape Lab reach of Red Butte Creek.



B. RESEARCH QUESTIONS

- How can we improve water quality in a measurable way that also allows us to determine unintended consequences?
- How will carbon and nitrogen (currently stored in the soil) destabilized by the new landscape design impact the creek? How significant will these impacts be?
- The assumption is that fertilizer and pesticide application harms the creek. How do landscape changes alter this? Are there measurable improvements?

C. DATA TO COLLECT

Pre-and post change:

- Annual fertilizer and pesticide applications
- Nutrient and chemical composition of RBC water samples

D. FREQUENCY OF DATA COLLECTION

- Every two weeks (coordinate with iUtah data collection).

A. METHODOLOGY

» Reduce amount of lawn from understory of the Gambel Oak Grove, and plant more water wise landscape. Create a low irrigation zone in the Oak Grove.

B. RESEARCH QUESTIONS

» What are the impacts of reducing supplementary irrigation to the Gambel oak stands?

» Which low-water use plants thrive in this area? Which do poorly?

C. DATA TO COLLECT

» Pre- and post-change oak health metrics

» Pre- and post-change soil nutrient composition

D. FREQUENCY OF DATA COLLECTION

» Monthly during the growing season.

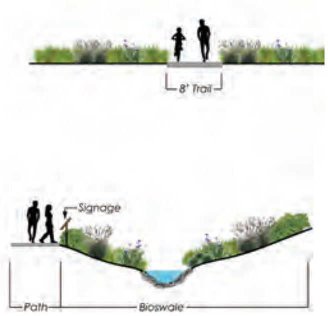
A. METHODOLOGY

» The Williams Building landscape will transform from primarily open lawn, with few people using the landscape, into the Landscape Lab: a place designed for active research and both passive and active recreation.

B. RESEARCH QUESTIONS

» How do different features and amenities influence different connections with the environment?

» Which areas in the landscape receive the most use?



C. DATA TO COLLECT

» Conduct both before and after surveys of building occupants who are regularly using (or at least proximate to) the space.

» Observe paths and other areas for signs of wear, which indicate degree of use.

D. FREQUENCY OF DATA COLLECTION

» Initially two times - pre and post landscape change. Consider conducting additional surveys after 5 years, or when significant landscape changes occur.

A. METHODOLOGY

- The test plots ajacent to the Williams Building outdoor terrace are intended as a flexible area that can accomodate multiple types of experiments over time. The could also be converted to raised beds and used as kitchen gardens for the Williams Building cafeteria. An initial experiment could to observe root depth of plants started from tubelings compared with those started from 1-gallon containers.

B. RESEARCH QUESTIONS

- Which plant starts establish more quickly?
- What is the length of time until each type of plant start reaches maturity?
- Which start type uses water more efficiently? At which point in its life cycle is this most apparent?

C. DATA TO COLLECT

- Plant size
- Plant water use
- Plant growth rate

D. FREQUENCY OF DATA COLLECTION

- Twice during the growing season.

LANDSCAPE SYSTEMS

SECTION 06

WATER FLOWS

Storm water runoff flows on site are directed down hill, into a series of connected bioswales. The easternmost set of bioswales are designed to treat run-off from the parking lots as well as the roof of the parking structure. The bioswales which lead downslope from the southwest facade of building to Chipeta Way treat runoff from the roof of the Williams Building.

The roof runoff and parking lot runoff are treated separately to facilitate designed experiments looking at the differing nutrient and chemical composition of the stormwater, and assessing its impacts on plant communities within the bioswales. Within these two main flows are two systems for bioswale flow, in order to test function within each system.

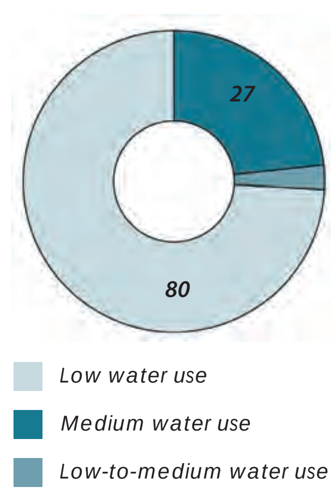
Another designed experiment involves the bioswale performance. Bioswale A was designed to retain and store storm water runoff, while Bioswale B was designed to infiltrate storm water runoff into the groundwater.

An additional bioswale concept to be explored will be the "minimal" approach, an option requiring minimal regrading of the site, with minimal soil disturbance.

SOILS

Different soil mixes should be used in the two types of bioswales in order to facilitate different water flows. Bioswale soil mix A is designed to encourage water retention to irrigate the plants in that location. Bioswale soil mix B is designed to encourage infiltration into groundwater.

Plant water use (108 plants total)



PLANTS

Plants were chosen based on a variety of criteria related to both ecological performance and aesthetics. Plants were intended to:

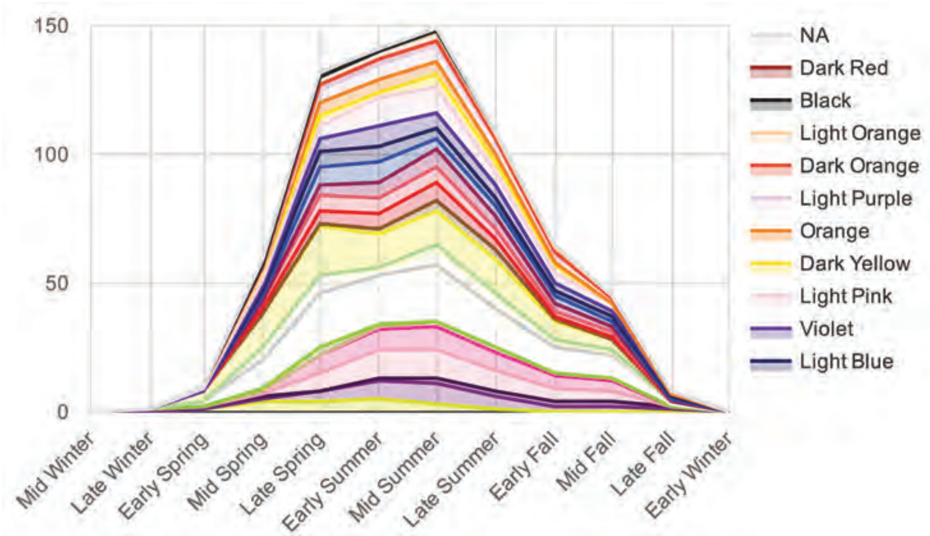
» increase biodiversity on the site;

» filter storm water runoff;

» reduce the need for both water and fertilizer; and

» maximize plant water uptake during the hot summer months via strategically

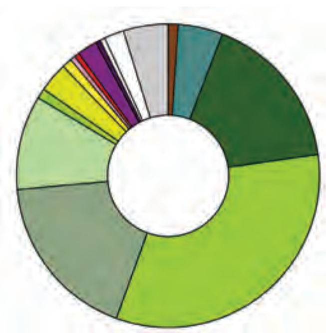
Bloom colors



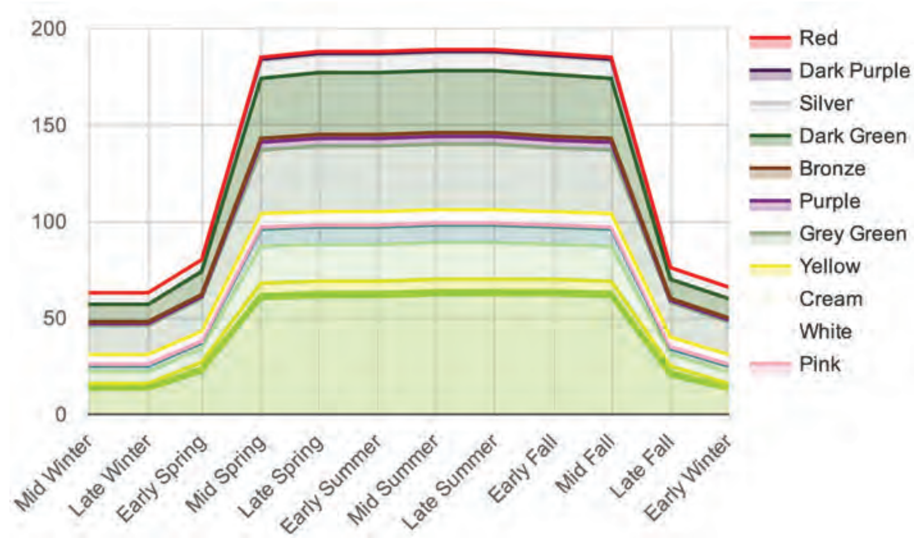
placed shade trees.

75% of the 108 plants selected for the Landscape Lab are classified "low water use," while 25% are classified "medium water use." All bioswale plants are low water use.

Aesthetic goals for plants included creating a meadow landscape with multiple habits,



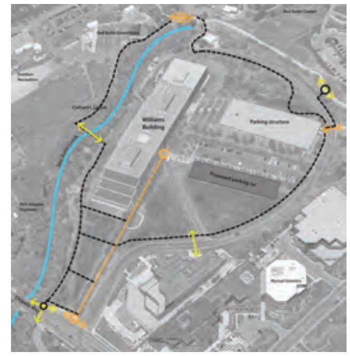
Leaf colors



colors, heights, and leaf textures, as well as a long blooming seasons that would inspire exploration and delight. The Landscape Lab flowering plant season begins in early spring, peaks from mid-spring through late summer, and blooms remain robust through mid-fall.

Leaf color also creates aesthetic interest, and plants were selected to create visual interest year round.

CIRCULATION



Proposed circulation and connection points.

Making key connections within the Williams Building site, as well as establishing new connections to wider circulation networks was a key component of the Landscape Lab project. The design group looked at how to better connect the interior uses of the building the landscape and the Red Butte Creek corridor, as well as how to better connect the site to the Bonneville Shoreline Trail (BST) and the Research Park area.

The primary access to the Williams Building is on the east side via the main entrance and lobby area, and leads west outside the buildling to an existing patio space, primarily used by building tenants and visitors to the building's cafeteria. A strong connection from this space to the Red Butte Creek corridor provides users a better access point to the regional trail system, as well as a more established opportunity to enjoy the Landscape Lab.

A key driver of the circulation for the site is the trail connection from Chipeta Way east towards the BST. With plenty of space above the flood line of Red Butte Creek, the trail takes users uphill from Chipeta Way through some of the "designed experiments" of Landscape Lab. There is a proposed shared-use path along the creek ending at Chipeta Way. The Landscape Lab project will be a continuation of this path, leading users along the creek. Due to a major pinch point between the creek and the Williams Building loading dock area, the proposed trail will cross the creek mid-way up the slope and continue on the north side of Red Butte Creek, where it will connect to the BST near the service entrance to Red Butte Amphitheater.

Example of bridge with visual access.

The project scope initially called for a trail to run alongside the eastern bank of Red Butte Creek, on the Williams Building Property, although points of connections to the western bank were considered as a long term goal for the project. It soon became clear that the freestanding wall which screens the building loading area created such a narrow passage along the creek that significant intervention in the streambed would be needed to meet safety requirements for a trail.

Members of the design committee approached Red Butte Garden to discuss the feasibility of a bridge across Red Butte Creek that would connect to a trail along the west side of the bank. Red Butte Garden was supportive of the idea, and it was determined that this would be the best solution for the trail route.

Example of viewing platform.

Additional circulation points were built into the plans for the Williams Building site. A path connecting users of the adjacent Myriad Genetics Building to the Williams

Building will provide a better route for people walking to the building to use the cafeteria facility. A sidewalk will be added to the site along the service road leading up to the building, providing a better pedestrian route for those walking uphill, eventually connecting them to the Red Butte GardenVisitor Center just east of the Williams Building parking structure.

LIGHTING

The design group determined that lighting on the site was desirable along the main trail route for safety of users. Lighting will be mainly downward facing, in keeping with "dark skies" concepts. The final spacing and type of fixture will be determined by project budgets at the time of construction, but the general safety of the corridor would be improved with a base of trail lighting through the Williams Building site.

Decorative landscape lighting could be used in key locations, and should be used sparingly. Uplights on some of the larger trees could add to the overall quality and enjoyment of the landscape, and provide some visual interest to the site generally. This type of lighting should be focused near the building itself, and should primarily be used along routes to the entrance, or at key views towards the building. Minor paths or trails through the site will not be lit at night.

SIGNAGE

As an experimental and education facility, signage on the site will convey information to users regarding the processes and experiments being conducted on the Landscape Lab site. This signage should be graphic in nature to illustrate the site's systems (water flows, planting schemes, etc) and provide information that will educate the public and students about green infrastructure. Educational signage should cover multiple concepts, including, but not limited to:

» bioswale use to reduce impacts from site runoff;

» groundwater recharge and pollutant uptake;

» Red Butte Creek's changing nutrient load;

» Red Butte Creek's patterns of streambank erosion;

» Changes in plant biodiversity and its impact on animal life at the Lab; and

» the role specific plant species play at the Lab.

Educational signage should be used primarily in the areas where specific experimental designs are constructed, or where desired environmental or social outcomes are anticipated to take place.

Wayfinding signage should be included at key connection points for the site, such as at the connection to the Bonneville Shoreline Trail and at Chipeta Way. Distances to other destinations could be included on this signage, as well as the users' location in relation to wider bicycle and pedestrian networks.

IRRIGATION

Supplementary irrigation is required for the site to ensure the long-term success of the plants in Landscape Lab. Drip irrigation will be ther primary method of providing water to establish plants during the first two years after planting, and any additional irrigation needed during dry summer months.

The plant types throughout the site should be grouped by the frequency of additional irrigation needed. The simplest way to group these plants will be by number of additional waterings needed per month. While some areas may be determined to need no additional irrigation once established, it may be necessary to provide some irrigation during unusual periods of drought.

The irrigation system should usea "smart controller" (such as WeatherTRAK), and be programmed to isolate each area and provide only the frequency and volume of irrigation needed. This system should also have rain sensors located on site to shut off the irrigation cycle if rain is providing the needed water.

In order to track the water usage on site, data on the amount of water being applied to each individual irrigation zone should be collected. This information will be important to track for researchers using the site for experimental landscapes.

Signage on site should detail the basic concepts of the irrigation system and provide the public needed information to implement similar water saving systems in their own home landscapes.

MAINTENANCE

A key driver of converting the Williams Building site into Landscape Lab is to reduce the frequency and cost of maintenance. By definition, xeriscape requires less frequent water, fertilizer, pruning, mowing, and other maintenance activities. The reduction of turf grass on the site will also change the amount of green waste produced on site.

	January	February	March	April	May	June	July	August	September	October	November	December
Maintenance Schedule Landscape Lab												
Plant Care												
Monitoring												
Pruning as needed												
Deadhead plants												
Fertilize shrubs												
Fertilize Perennials												
Cut back perennials and grasses												
Planting Beds												
Edging												
Weeding as needed												
Mulching												
Soil Testing												
Leaf Removal												
Pest Management												
Monitoring												
Winter Care												
Snow removal as needed												

BIBLIOGRAPHY

APPENDIX A

Anderson, Nathan (2015). Red Butte Creek Geomorphology. University of Utah Global Change and Sustainability Center.

BioWest Inc. (2010). Salt Lake City Riparian Corridor Study. Prepared for Salt Lake City Department of Public Utilities. Available online at: http://www.slcgov.com/utilities/publicutilitiesriparianredbutte

Center for Watershed Protection (CWP). (2005). Urban Subwatershed Restoration Manual Series, Manual 1-11. Available online at: http://www.cwp.org/online-watershed-library/cat_view/64-manuals-and-plans/80-urban-subwatershed-restoration-manual-series?limit=100&limitstart=0&order=date&dir=ASC

Clemson Riparian Corridor Master Plan: http://www.clemson.edu/public/hunnicutt/documents/riparian_corridor_master_plan.pdf

EPA Case Study, "Green Infrastructure in Arid and Semi-Arid Climates," May 2010.

ERM (2012) Screening Level Ecological Risk Assessment - Final, Chevron Pipeline June 2010 Crude Oil Spill, Lower Red Butte Creek Salt Lake City, Utah. Prepared for Utah Department of Environmental Quality, Division of Water Quality

Houdeshel, C. Dasch et al, "Bioretention Design for Xeric Climates Based on Ecological Principles," *Journal of the American Water Resources Association* (JAWRA), 2012, 1-12.

North Carolina State University Rocky Branch Restoration: http://www.bae.ncsu.edu/programs/extension/wqg/srp/rocky_branch.html

Red Butte Canyon Natural Area Research Natural Area website. http://redbuttecanyon.net/

Salt Lake City Riparian Corridor Ordinance. (2010). Available online at: http://www.slcdocs.com/utilities/StreamStudyWebsite/RCOOrdinance/SLCRiparianOrdinanceasAdopted.pdf

Salt Lake County Engineering and Flood Control (SLCO). (2012). Guidance Document for Stormwater Management, Chapter 7, Long Term Stormwater Management. Available online at: http://www.pweng.slco.org/stormwater/pdf/longswplan.pdf

Salt Lake County Watershed Planning and Restoration Program (WPRP). (2012). Riparian Restoration and Streambank Stabilization on Red Butte Creek. Available online at: http://www.deq.utah.gov/locations/R/redbutte/docs/2011/12Dec/proposals/App9SLCORiparianRestorationStreambankStabilizationRBC.pdf

Salt Lake County Watershed Planning and Restoration Program (WPRP). (2009). Water Quality Stewardship Plan. Available online at: http://slco.org/watershed/wtrQualSteward/

Salt Lake County Watershed Planning and Restoration Program (WPRP). (2014). Stream Care Guide: A Handbook for Residents of Salt Lake County. Available online at: http://slco.org/watershed/pdf/StreamCareGuide_SLCo1.pdf

UC Davis Putah Creek Riparian Reserve: http://putahcreek.ucdavis.edu/

University of Georgia Watershed Management Plan: http://sustainability.uga.edu/wp-content/uploads/2012/08/UGA-Watershed-Management-Plan-2013.pdf

University of Utah Bicycle Master Plan. (2011). Available online at: http://facilities.utah.edu/static-content/facilitiesmanagement/files/pdf/UniversityOfUtah-BicycleMasterPlan.pdf

University of Utah Campus Design Standards. (2015). Available online at: http://facilities.utah.edu/project-resources/documents-standards/design-standards.php

University of Utah Campus Master Plan. (2008). Available online at: http://facilities.utah.edu/campus-planning/master-plan/2008-master-plan.php

University of Utah Red Butte Creek Strategic Vision DRAFT 10-12-15

University of Utah Stormwater Management Program Plan. (2015). Available online at: https://ehs.utah.edu/environmental-programs/storm-water-pollution-prevention/storm-water-management-program-plan

PREVIOUS STUDIES

APPENDIX B

MEETING MINUTES

APPENDIX C

Williams Property Design Committee Meeting, August 27, 2015

Attendees

- Sarah Hinners
- Tami Cleveland
- Jonathon Bates
- Douglas Evans
- Braden Hellewell
- Diane Pataki
- Brenda Bowen
- Matthew Brownlee
- Sue Pope
- Myron Wilson
- Robin Rothfeder
- Ivis Zambrana (filming)

Overview of project concept (Sarah)

1) Trail connectivity from the Bonneville Shoreline Trail to Chipeta Way

2) Re-landscaping the turfgrass area on the western and northern sides of the building

3) LID/GI stormwater treatment for the new parking structure

Role of the Design Committee

- Set goals prior to meeting with the consultant
- Meet with the consultant several times to contribute multiple perspectives to the design process

Questions about the scope of the project

- Does the turfgrass segment at the southwestern corner of the building need to be incorporated into the Phase 1 re-landscaping project to maintain aesthetic consistency? (Jonathon)
- On one hand, we want to meet aesthetic goals; on the other hand, we want a research control
- The INC building is another potential 'control site' that also has extensive turfgrass
- Is including a creek crossing to Cottam's Grove feasible/desirable? Something to plan for in a future phase of the project? (Robin)

Question 1: What is the fundamental goal/activity/process/question in your field?

Urban planning (Sarah)

- The goal is to understand human settlements and to create better ones. The process consists of both research and creative planning and design processes.

Geoscience (Brenda)

- Understand natural cycles and fluxes in physical and chemical systems; in particular (for this project), how does water move through the system (both over land and through the soil), and how does it interact with other components of human systems and ecosystems?

Ecology / Biology (Diane)

- Studies the interactions between organisms and their environments, and the interactions of organisms with other organisms.

Parks, Recreation, and Tourism (Matt)

- Falls under the broad umbrella of quality of life. How do human-environment interactions contribute to quality of life and sustainable relationships? What is the synergy between environmental health and quality of lifer

Facilities (Sue, Jonathon)

- Connect campus life with the foothills. Make sure that there is an appropriate blend of two different environments; ensure the operations and maintenance is accounted for; plan for health and safety of user groups.
- The balancing act of fiscal responsibility and ethical responsibility: work-life balance, sustainability balance, fiscal balance

Sustainability Office (Myron)

- The business of the University transitions to sustainable activity, in the broadest and audacious sense, and with a particular emphasis on climate change.
- Why the focus on climate change?
    - The University has signed the president's climate commitment
    - We perceive this as the most pressing and urgent challenge
- Demonstrating that environmental and social sustainability also impacts the bottom line
- A private and a public frame: public

Campus Planning (Tami)

- This project will start to inform the Campus Master Plan in a new way that has not occurred in the past, and will be looking to carry forward into additional projects in the future.

Question 2: How does your field engage with land and people?

Urban planning (Sarah)

- Focuses on human wellbeing. Ecosystem health and access to 'nature' is seen as a critical component of human wellbeing.

Geoscience (Brenda)

- In contrast to planning, humans are just one piece of the system and often a negligible piece. Land is a major area of study. The physical sciences tend to objectively quantify knowledge, without necessarily putting any value assessment. The science can be used to inform value-laden decisions. Seek to understand the system without wanting it to be a certain way.

Ecology (Diane)

- Human ecology focuses on human activity, interactions with the environment, etc. Non-human ecology is what biologists historically studied; but, this separation has started breaking down. The science is now attempting to incorporate human
- This shift is reflected in the origins of our project and the move from the goal of 'restoration' to the goal of 'revitalization.'

PRT (Matt)

- Place-based, within the lived experience. That experience isn't necessarily across a lifespan. With RBC, part of the lived experience might just be the college years.

Question 3: What does revitalization mean for you, your work/research?

Planning (Sarah)

- (Re)establishment of a lasting, engaged, and mutually supporting relationship between the human community and the RBC watershed. Outcomes: clean water, functional ecological processes and communities, beauty, access for contemplation, creative expression, recreation, and learning.
- Real estate, finance (Jonathon)
- When I think of revitalization I think of energy.
- In the context of this project, it's about taking an underutilized part of campus and taking back into the goals, purpose, and function of research park: private-public partnerships, maximizing the value of the research complex, and finding a balance between sustainability, environment, and business/real estate development

- Gaining access to spaces that people don't know exist or can't actually use
- Take space that is under-utilized and make it something special

PRT (Matt)

- Connectivity: connecting populations to their environment; connecting physical spaces and travel corridors; connecting people to place; connecting people already present to those that will begin to use a new space
- Without revitalization we have unrealized, or total lack, of connections necessary for a functioning environment
- Ecological, social, or both

Geoscience (Brenda)

- Vitality = life; if we were to take the pulse of RBC, we would say it's in trouble
- The "re" is problematic - we're not 'going back' to something; we're moving forward

Sustainability

- Echoing the planning definition as nuanced and comprehensive

Project elements

- low water consumption
- minimal chemical inputs
- maximal infiltration
- variation in trail design elements and dynamic signage
- connectivity to campus and surrounding community
- better utilizing an under-utilized space
- beautification and aesthetic improvement
- measurement/evaluation/assessment of efficacy

Some basic research questions that any project should lend itself to:

- Minimizing water consumption and improving water quality - how do we design landscapes that meet these goals in a measurable way and that allows us to determine unintended consequences?

Water quality

- The assumption is that fertilizer and pesticide application harms the creek. How do landscape changes alter this? Are there measurable improvements? What are the processes at play with the soil and vegetation?

Water flows

- Is the site too small to measure changes in hydrology? Can we instrument outfalls above and below the project site? What about flows specifically from the rooftop?
- Can changing the sub-surface and overland flow have an impact on the stability of the bank and the rate of slope failure?

Green infrastructure

- How much do we need to implement (at what scale) to see a measurable change in the creek?

Trails

- How do different features and amenities influence different connections with the environment? We need a design that can function as a laboratory for exploring these questions. We want there to be enough variety in features and amenities so that the variability can be related to different responses and connections with place, rate of travel, etc.
- Variables: Routing, siting, tread quality, seating, signage, etc.
- We also want dynamic signage and the ability to measure human interactions.

Bank and channel

- Can we address these issues with this project? Can we incorporate classic stream restoration activities? Is this feasible/desirable?

Wildlife

- What are the impacts of changing landscapes on wildlife prevalence, diversity, etc.?

Beauty/aesthetics

- Can we do a before/after survey of building occupants who are regularly using (or at least proximate to) the space?

Miscellaneous questions and comments

- » This is a small piece of land, and these are lofty goals. The idea is to develop a process that can be repeated and scaled up over time.
- » We need a set of guiding principles, if not specific expectations, to bring to the consultant. We could also define physical elements we want to see manifested in the project (see above).
- » We want the University side of the design team to develop an interdisciplinary research agenda for this project. How do we generate new knowledge and cutting edge research, and integrate that with more conventional site design? (see above)
- » How do we balance competing goals? For example, how do we know that a trail doesn't cause ecological damage?
- » How do we incorporate research without a dedicated research budget? Is it sufficient to design the potential/ability to conduct research into the landscape? How do we provide an open door for students and faculty to work in this landscape and generate knowledge?
- » We are looking for designs that integrate and support experiments and pre/post assessments
- » An example of 'making science beautiful' (Diane) : Scientists working with artists at the Ecological Society of America, with different experimental blocks forming the petals of a flower!
- » What's most important is that we find a consultant who is willing to embrace a new paradigm. Be excited and able to help us facilitate an interactive process. We want them to be ready to overcome, and even welcome, unique challenges that arise along the way (Matt)
- » We need to be able to communicate a duration of the project to the design consultant. What we're asking the consultant to do is come up with a feasibility plan, work with the University design team to refine that plan, and then move to project implementation.
- » How willing is the consultant to have empirical data drive design activities and decision-making processes? How willing are they to engage with students and courses on campus?

Williams Project Design Committee Meeting, 11/4/2015

Attendees

- Introductions
- Mark Morris and Laura Bandara
- VODA landscape architects: design, policy, and planning
- Mike Brehm, Environmental Health and Safety
- Administers the University's MS4 permit
- Interested in 'campus as a lab' projects
- Matt Brownlee, PRT
- Kevin Jensen, Red Butte Garden
- Robin Rothfeder, CMP
- Braden Helewell, Real Estate Administration
- Sarah Hinners, CMP
- Tami Cleveland, Campus Planning
- Mallory Millington, Masters student in geology and geophysics
- Steve Burian, Civil Engineering
- Brenda Bowen, Geology and Geophysics
- Diane Pataki, Biology
- Sue Pope, Facilities Management
- Jonathon Bates, Real Estate Administration

VODA Presentation

Project objectives

Connect

- Connect site users to the creek
- Connect to trail network (existing and future)
- Safe and strategic access
- Recreation opportunities
- "There are a lot of physical functions of this space that we're trying to get in early on in the design process"

Educate

- Multiple educational opportunities (formal, associated with course work, or informal, as users move through the space)
- Built experiments / research opportunities (data collection)
- Case study for future projects (learning opportunities for repeating the process)

Enliven

- Destination for humans and non-humans
- Reduce erosion and site runoff
- Increase on-site infiltration
- Reduce irrigation water consumption (currently at the max possible water use)
- Improve environmental quality of the space

Red Butte Creek watershed

- Upper sub-watershed protected for more than a century
- Lower sub-watershed: increasingly urbanized, fragmented, and degraded
- Early (1950) and current aerial photos of the project site
- Creek alignment and vegetation have not changed dramatically, but impervious land cover has increased substantially in the watershed over time

Site analysis

- The creek itself
- The existing green/riparian corridor
- Primary building access points
- Gas pipeline at the top of the property
- The space around the building: 99% turfgrass

- Needs to be added to site map:
    - Underground high voltage power lines (Jonathon Bates)
    - iUTAH streamflow sampling site (Sarah Hinners)
- Views from the building: what views are we emphasizing, what views are important not to block?
    - Access to the creek can be visual; it doesn't all have to be physical

Other observations

- How do we use this entire site to achieve the project objectives? How do we maintain a legible, holistic landscape?
- Cottam's Grove: not part of the current project, but an important consideration for the current project and for future opportunities
- What about existing trees and riparian vegetation? (Sue Pope)
    - Most of what is present in the corridor will probably stay there; we're focusing more on the space around the building that is currently landscaped with turfgrass (Mark Morris)
- Connection with Bicycle Master Plan: this trail segment is an addition to the current plan (2011) that improves access to Bonneville Shoreline Trail and Chipeta Way

Zones

Split up the landscape into different zones based on potential future use and existing conditions; establish functional units that are more manageable in scope.

Zone 1

- The southern and western side of the building, between the parking lot and the building itself
- The approach (the "fairway"): a vast expanse of lawn, and a nice expanse of trees along the existing pedestrian way
- Probably the largest available space, with really no barriers for designed experiments; a lot of potential for future projects
- Visually, it establishes the approach to the building: needs to function scientifically, but also needs to be visually appealing

Zone 2

- Turfgrass area to the east side of the building
- Most opportunity for improved interface with the Williams building and direct connectivity with the creek corridor
- A focal point for both physical and visual access
- Some existing structures to work with, especially the small deck over the creek

Zone 3

- The narrowest part of the site, between the building and the creek in the northeastern corner of the property
- In a few locations, there are literally only feet to work with, including some challenging engineering problems if a trail is to run through there, in particular some retaining issues that will need to be addressed
- Probably the most challenging zone on the site

Zone 4

- North side of the access road
- Not really a public area
- Conversion of steep lawn to low-maintenance landscape: it does not need to be lawn here
- Potential for pedestrian connection to Red Butte Garden entry
- Designed experiment would be challenging because it's such a long narrow corridor: it would mainly be about landscape change, reducing maintenance, etc.
- In this zone, the pedestrian connection to Red Butte Garden dead-ends and moves into the road

Zone 5

- South side of the access road
- Large and unusual amphitheater built into the hillside: used once or maybe twice a year; it's an unknown asset, most academic users even within the building don't know it exists; it is in need of repair

- The retaining function is performed well; as a public space, it is not well maintained
- Large existing gamble oak stand that is incompatible with turf as far as water needs and maintenance
- Large areas available for potential research projects

Feedback on the Zones approach

- Sarah Hinners: The holistic view of the property doesn't necessarily mean we will redesign the whole property as part of this project; it does mean that we need to be aware of the whole site as we engage redesign in specific locations; the focus areas for this project are Zones 1, 2, and 3 (with 3 the most challenging component)
- Laura Bandara: we want this to read as one coherent landscape, not a fragmented patchwork of landscape elements

Case studies

Jordan Valley Conservation Garden Park

- Close by; some elements very relevant, some less so
- The main purpose (and excellent function) of the facility is public education: landscape examples for the public to take back to their own homes
- The Jordan River runs 200 yards away from the site; a few smaller channels and canals closer around it
- Very discrete paths and exhibits with very specific design intent: these smaller discrete parcels that serve specific purposes provide a good example for the Williams project
- What sort of scale are we talking about for data collection, and how do we fit that into the circulation of the site?
- Diane Pataki: I'm concerned that this site (Jordan Valley) is not inspiring; it won't change hearts and minds
    - Mark Morris: that's an important point, but as a model for dividing the whole site into smaller functional pieces it is a good case example
- Mike Brehm: there are other drivers for Jordan Valley, including regulations and state requirements; to the extent that the Williams Project can measure the human element of green infrastructure, that would be really good; at Jordan Valley, they can just count how many people visit the garden; at the Williams site, tracking the educational value may be more difficult and also provide more value-added

Wetzgau Landscape Park, Germany

- Another example of dividing a larger area into smaller functional units
- A beautiful public place with specific design motivations: a good example of different design elements that can be adjacent to each other, experimentally functional, and still beautiful
- Diane Pataki: The most important research element is replication; how the experimental setup is shaped and configured in space can be flexible, but more critical is the capacity to replicate experiments, which we are always lacking in urban environments

Stormwater runoff reduction

- A driving motivator for this project for several reasons
- There is plenty of space on-site to infiltrate water in a more 'natural' way using green infrastructure designs
- We want this stormwater infrastructure designed in such a way that there is a research component with scientific capacity; VODA needs faculty input in terms of how to implement this in a scientifically functional way
- Laura Bandara: Do you want us to be creating specific designed experiments, or a flexible framework to indicate where replicable experiments would occur?
- Diane Pataki: Are there things you (VODA) would like information on, for instance design elements that are supposed to reduce water use or runoff? Do they work? I want to test designs that are commonly implemented and assumed to be effective, and find out of they are actually effective. We may be able to provide useful research results to VODA to inform their design work.

Matt Brownlee: It's the same in the social environment; there are standard implementation strategies and assumptions that could be subjected to more rigorous questions and research.

VODA: We need your specific research questions; where we can come in is with configuring the experimental treatments, but not conceptualizing the science; we need to know if you have specific questions that you would like answered, that we can begin to address physically.

Sarah Hinners: Given that there is no dedicated research funding for this project, do we design a specific experiment in the hope that someone will eventually have the funding to do it; or, do we design the 'container' for a variety of different possible questions, so we create a space that is beautiful and functional as a landscape but there is flexibility in terms of what is studied there in the future?

*Note: This is the same question posed by Laura, above. In both cases the group did not provide a clear answer, with the exception of Brenda (see below). On the faculty end, it may not be a pressing issue, but on the design end it may be important to have a clear answer very soon.

Steve Burian: Is there potential for matching funding opportunities? When will the funding be spent and on what timeframe? It might be used as a match for grants that we could pursue, that are usually pretty easy to get if you have a 2/3 match.

Brenda Bowen: I would hope we can do both of the ideas Sarah hit on; specific research designs, and also a more flexible research space. Also, it's important that we follow through with collecting baseline data and then monitoring data after implementation.

Mark Morris: the building probably has good documentation as to water usage; the iUTAH group may have data we can use regarding water flows and quality.

Diane Pataki: no matter how careful we are, this project will impact the creek; iUTAH needs to be made aware of our activities, and we need to be collecting data on a schedule that is meaningful to them.

Sarah Hinners: Just collecting data on the construction process itself is a valuable research contribution.

Laura Bandara: Some questions I've thought a lot about are: which plants are the best in terms of root mass for erosion control; what are the differences between a plant bed that started with 1-5 gallon plants versus tublings (this is important if for no other reason than tublings are much less expensive); also, I often hear designers talk about creating habitat, but the question is for what species, and is attracting that specific species actually possible?

Mark Morris: often for a more 'natural' landscape you will plant different species in equal amounts and then track them down the road to see if one or two species have started to dominate the ecosystem; successional planting is also a key question – how do you monitor the fact that other plants will 'invade' the designed landscape

Diane Pataki: That's a big question that is a major uncertainty in ecology; we don't know why if you put a plant community together, it so often ends up being a different community. It's a tough nut to crack, but it's a really key question; we don't even use the word succession any more because the results of community composition are so unpredictable.

Additional discussion of research questions: Water consumption and plant communities

» A lot of options for research: study potential designs that are supposed to reduce water consumption and look nice; but, do they work and under what conditions?

» Personally (Diane), I'm all about roots, which are hard to measure, but it seems that whatever you plant, if it has deep roots it won't need as much water; you can plant species that have a bad reputation for using water (like lilacs), but if they are old and with very deep roots, the might use less water than a desert shrub; if we just put big trees over the lawn, it would probably cut the water use in half.

Data that Jonathon and Braden have

» A sub-meter than meters the actual irrigation water; it is a manual read (not trended electronically); it would be nice to have electronic metering that ties into the building irrigation system

Tree selection

» Jonathon Bates: The Linden trees have recently been failing on site at a rate near 50%. The landscape experts say that the dry winters are causing them not to have winter water. It would be great to tie this issue into a research agenda. Do we study the existing trees in the context of environmental change? Do we remove the trees and study their replacement?

» Diane Pataki: Actually, a lot of the older trees in SLC are failing, but we're not sure why. Is it drought, and people watering less? Is it pathogens, possibly interacting with drought? Is it pollution? It's not just linden, but maple, ash, and most of what we used to plant; there might be experiments to test methods of preserving the trees that are already there. We should also be aware that if we do stop watering the lawn, the trees on site will probably suffer.

Natural pest controls

» Jonathon Bates: Semi-annual invasion by box elder bugs; is there a natural landscaping solution that helps us solve this without introducing pesticides?

Do we want to try to attract pollinators to the site, and if so where?

» Sarah Hinners: USU is doing pollinator research in red butte garden; it would be interesting to expand that down the creek somewhat

» Jonathon Bates: I love the concept of bringing this down from the garden into a much more urban, office complex setting

Vegetation

» Do we want to incorporate food or edible landscapes?

» Maybe open a line of communication with campus community gardens and identify collaborative research potential

» Jonathon Bates: This is a great concept that could potentially be tied into the on-site café.

Kevin Jensen: Green infrastructure facilities could be made into a replicable experiment that tests designs specifically for arid climates.

» Most currently recommended GI designs are based on experiences in much wetter climates: Portland, Seattle, Philadelphia, Chicago, etc.

» We could do replicable experiments using the same plant palette, similar sized basins, etc. but with different amounts of water, and see what it takes in this climate to feed green infrastructure and have it look beautiful. Designs imported from the east coast might require supplemental irrigation, and what that means here is of great interest. What plant species do well with varying amounts of supplemental irrigation?

» Sarah Hinners: there is a complementary research effort going on at the GIRF site across the creek that addresses some of these questions as well (although not a functional scale)

» Food and edible landscapes, tied into green infrastructure: this has not been studied as far as we know.

» Brenda Bowen: We should ask research questions about energy use related to all of these goals; do we reduce water use but ramp of energy consumption?

» Diane Pataki: New landscape designs will potentially destabilize carbon and nitrogen in the soil; pollution really sticks to the soil underneath lawns, and if we redesign the site we might end up putting a large amount of nitrogen in the creek. It's an overall question that ecologists have not wrapped their brains around – there are costs to messing around with soil that has been stable for a number of years.

» Mike Brehm: This could be an opportunity for Environmental Health and Safety to test different design standards on-site.

Closing

Laura Bandara: We will fill in these research topic areas with specific questions, and reach out both within and beyond the formal committee to the most appropriate faculty to specifically address those questions.

William Project Design and Steering Committee Meetings, 12/9/2015

Attendees

- Mark and Laura with VODA
- Kevin Jensen, Red Butte Garden
- Stephanie Connell, FM Sustainability
- Justin Barnes, Project Manager for Construction
- John McNary, Director of Campus Planning
- Brenda Bowen, Director of GCSC
- Jonathon Bates, Director of Real Estate Administration
- Tami Cleveland, Campus Planning
- Mike Brehm, Environmental Health and Safety
- Mike Perez, VP of sustainability
- Braden Hellewell, Facilities Manager for Williams Building

Project Working Title: Red Butte Creek at the Williams Building, Landscape Lab

VODA Inspiration: Wallace Stegner – "The West is less a place than a process"; "Get over the color green"

- This is especially germane to the Williams project. What we're looking at is processes: what are processes that can be improved, enhance, added, eliminated, etc.?
- The expectation that landscapes should be lush and green is not fully consistent with our western landscapes - but we can still have places that are beautiful, diverse, and appealing

VODA Framework for overall goals

Connect

- Site users to creek
- Trail network
- Safe access
- Recreational opportunities

Educate

- Maximize opportunities on site
- Create experiments
- Develop a case study

Enliven

- Destination for humans and nonhumans
- Reduce erosion and runoff, increase infiltration
- Reduce irrigation water consumption and chemical application
- Improve environmental quality

VODA Framework for research questions and project implementation

People

- Landscape features, connectivity, circulation, visual access

Plants and Animals

- Looking at increasing biodiversity on site, habitat for birds and insects, etc.
- Designed experiments with comparable plots for control and test treatments
- Xeriscape – plants zoned and placed by water usage
- Good vs bad
- If you can tell it's xeric, it's generally bad
- Good – can still be lush, but design is 'zoned' based on water use to reduce consumption
- No supplemental irrigation: native and native adapted
- Low supplemental irrigation: irrigated infrequently, maybe a couple days a month
- Moderate supplemental irrigation: irrigated more frequently for a more lush appearance

Water

- Creating systems that manage water differently is a key component of the project
- Currently, water is piped to the creek as rapidly as possible - how do we slow that flow down to increase infiltration, water quality improvements, etc.?
- Creating a system of bioswales that slow the water flow, increase infiltration, etc. This requires a lot of space, which there is a great deal of on site to support green infrastructure. Swales can/should run in parallel with existing grading on site.
- Soil on site is porous, which can really support groundwater recharge
- Where do roof drains connect to the stormwater system? How can they be diverted and used for more productive purposes? Further analysis is needed to answer these questions, but there is major interest in doing so successfully.

Design Concepts

Entry

- The 'fairway' area west (downhill) of the building
- Proposed trail paralleling the creek, running through a series of control and test plots that support designed experiments
- **Also need a secondary trail forming a connection across the site (south to north) from the sidewalk to the creek
- Questions: What are the options for a porous trail surface for the main trail (east to west)? What are the design priorities for other secondary/informal trails? (these should definitely be porous as well)
- Suggestion: The trail should involve minimal maintenance – something that does not require major inputs of time/energy/manpower, especially during the winter
- Suggestion: Plants that need more water can be sited closest to the bioswales; more desert-adapted plants can be sited further away

Creekside

- This is the main building entrance, with an existing patio area
- We want to create a more functional space between the building and the trail: food production, amenities for building occupants, etc.
- This is the most logical place to maintain some lawn on site, and the committee shows widespread support for this assessment
- As a western facing slope, the landscape in this zone would benefit from additional trees and shading
- **Suggestion: add the 100 foot buffer zone to the site plan
- **Question: What do we do about the major constriction at the northeastern corner of the building?
- Work around the tight corner formed by the retaining wall - this would require a new retaining structure with major associated costs
- Alternate: Run the trail through the already paved surface - this would be much less expensive, but also much less aesthetically desirable
- The committee (especially Jonathon) does not prefer the alternate approach and is interested in creative design solutions to overcome the existing constraints.

Future connection to Cottam's Grove

- Where should that happen? We want to plan now to be ready to do this in the future.

Meadow

- This area includes existing and new proposed parking areas; it presents additional opportunities for educational areas and test plots
- **Suggestion: there should be a connection from the main road moving toward the building
- Myriad employees would really benefit from better connectivity to the Williams building café
- add a sidewalk to the schematic design, in addition to a more meandering path

- **Suggestion: A nice seating area for smokers that is aesthetically pleasing and an appropriate distance from the parking structure; possibly covered for winter time

Amphitheater/Grove

- Add trees/shading to the amphitheater; remove some lawn and replace with more xeric landscape, which would also protect the railroad ties from frequent watering
- Remove lawn from understory of the gamble oak grove, which has drastically different water needs compared to grass
- Build a trail to provide visual access to the solar array
- Again, there is a restriction on the trail alignment: can the diesel storage tank be moved further from the creek?
- When Goldman Sachs leaves, the drive up 'quick connect' will likely be removed, and there should be more opportunities for clearing up space here
- ** Question for further consideration: Signage to direct people (especially concert goers) off the road?
- The concern is lighting; it's not a problem to have people on the road, but it's not the most aesthetically pleasing walk. The problem with moving them to the BST is the need for lighting there

Design Committee Feedback

Diane: the most important thing is replication; small individual plots that facilitate control and experimentation, including a control plot that maintains the existing lawn as is

Minimum lot size? - it depends; small statured plantings can have a smaller plots (like a lawn), as opposed to a grove of trees, which would have to be larger

Spatial configuration can be negotiated, but we need at least 10 plots for control and test designs

Removing lawn from the Gamble Oak understory - a great experiment right there if some of the turf is removed while other plots of turf remain in place

Intermingled plots throughout the landscape will facilitate the best experimental setup, rather than a simple 'half and half' design

Brenda: is there a specific area that would support an outdoor learning facility?

The employee area between the creek and the building is probably the most appropriate space; there could be programming for building occupants and also for teaching opportunities. The key will be designing for multiple, scalable activities by different user groups.

The existing creek-side deck may be converted to a more functional educational space

This is a good existing amenity and visual access point that can/should be better utilized

Brenda: is there a place for people to physically access the water?

The site may be too incised for physical access, but there are great opportunities for visual access

At the creekside constriction point (northeast corner), there may be an opportunity to design physical access when a new trail and retaining structure is constructed

Further questions/considerations about the site:

Soil

- Existing soils are highly erosive and would limit plant choices. What will it take to have a more diverse plant palette?
- What sort of fill was used when the building was constructed?
- How extensive is the soil compaction from the current management regime?
- Questions about soil, both for design/engineering/landscaping and also for microbial biology/ecology/geology, are important research areas of significant interest to the committee

Water

» Anticipated water volumes in the stormwater infrastructure need to be quantified to engineer green infrastructure solutions

» There is significant interest in capturing stormwater from the building and garage rooftops to be utilized on the landscape

» Is there potential for green roof implementation? 80-90% of the surface area will be covered in solar panels, so this is probably not feasible

Pests

» Integrated pest management is difficult if not impossible for box elder bugs - the best approach is to examine and seal entry points to the building; changing the vegetation may reduce pest concentrations as well

Slope and retention at the constriction point (northeast corner)

Bioengineered bank stabilization:

» Using living material to achieve retention

» Pros: often cost effective

» Cons: might require significant excavation, may not be feasible with extreme incision

Geoweb:

» Polyethylene cells retain slopes with a near vertical profile

» Inhibits erosion and controls rill and gully formation

Hercules retaining wall:

» Concrete block retaining wall with spaces for plantings

» Supports slopes from 40-70 degrees

» Before making a decision, we need to look at the cost implications of these different systems and the implications of further soil analysis

** We also need to understand the potential permitting implications of these options, especially as it concerns flood control**

Phasing

» It would be best to work from the creek out

» Trail infrastructure is straightforward

» The site is easily compartmentalized to be addressed based on priorities

Phase 1

» Entry: the fairway, from Chipeta up to the western end of the building, or up to the loading dock/constriction point

Phase 2

» Creekside

Phase 3

» Meadow and Amphitheatre/Grove

Steering Committee, further input

Mike Brehm

» Campus Environmental Health and Safety staff, especially those responsible for MS 4 permitting, are very interested in opportunities to benefit from soils research, stormwater research, and green infrastructure designs

» Can we create an exhaustive soil profile on site and emulate the most typical soils on campus, to generate findings that are broadly applicable?

» Can we quantify stormwater quantity and quality, create green infrastructure designs, and know that the findings are broadly applicable to the main campus?

» Suggestion: Get Salt Lake City and County on board for funding partnerships and broader implementation potential

Mike Perez: is there a schedule and is there a budget?

» This is the feasibility stage - it will inform the budget and the phasing (we don’t see this all happen at once)

» Existing funding streams will support project implementation and ongoing O&M costs, which we hope to ultimately reduce

- The plan is to design development level drawings by the end of February, including cost estimates and construction phasing at that point

How does the research component fit in?

- We are incorporating researchers every step of the way - it makes the project more difficult but also more meaningful
- What can we do to develop the entire corridor as best we can for maximum use?
- This is effectively an outdoor classroom - as we develop it, we want to be mindful of how this can help to secure ongoing funding
- Also want to estimate O&M cost savings and water cost savings - the challenge is that on parts of the creek where there is currently no O&M, there will be additional costs incurred when we develop along the corridor

Stephanie Connell: The project has important connections with the intended landscape master plan and with LEED for existing buildings

RBC Design Meeting 1/15/2016

Entry

- » tiered series of bioswales that allow water to percolate down from one swale to the next, following the slope
    - » provides overflow control
    - » functions as a microcosm of a watershed - ability to visualize water movements and flows
- » **there are many important considerations about appropriate swale designs in terms of hydrology, soil depth, soil type, rooting depth, plant community composition, substrate composition, etc.
- » ideas about alternating different swale designs to introduce experimental controls
    - » one swale split into two different designs laterally
    - » uphill swales will receive less water than downhill swales, provides a natural experimental setup
    - » "short channel" designs (?) to test low flow conditions (Jason Draper) and water storage in the root zone for plants.
- » there will definitely be supplemental irrigation, but how much depends on the plant communities
- » Now is a good time to start coordinating bioswale designs with U faculty who are studying bioretention, namely Steve Burian and Christine Pomeroy. Sarah will reach out to them.

Creekside

- » accessibility from building to trail amenity should be a top priority
- » will leave turfgrass in place in the terraced area moving down toward the creek; the only lawn intended to remain on site
- » **possibility to have a foot bridge crossing over to Cottam's Grove
    - » would expect this to cost at least a couple hundred thousand dollars
    - » would potentially need to have ADA accessibility and lighting - but not if it's a trail, rather than a sidewalk, path, etc.
    - » questions of feasibility, administrative support, and timing (long vs. short term) need to be addressed ASAP
- » we may need a retaining structure following the changing gradient along the length of the trail (??)
- » discussion of the screening concrete wall and loading dock area
    - » something like a pier or a deck that provides visual access? - but it can't just be a dead end
    - » long-term it would be ideal to have a bridge that takes the trail to the other side of the creek where there's more room (activity density impacts at pinch point, as it is also near best direct access to creek)- there are major land use and land ownership questions associated with this idea; the next step is a specific conversation with Greg Lee (Red Butte Garden); again, questions of feasibility, administrative support, and timing
    - » need for a retaining structure if a trail is to run past the pinch point - can be vegetated, as discussed previously, but may change the nature of permitting requirements for the project (Jason Draper, Lynn Berni, and Mike Brehm should be further consulted about this)
- » maybe a student design competition could help work out the details.
- » Lynn: this particular area, again, is the one good opportunity for creek access, but also a relatively healthy stretch of riparian zone. Don't want to mess too much with the one section that's in pretty good shape.
- » **this problem will come up all along the creek: what do we do with the impervious areas and built structures that currently infringe on what should eventually be a protected area??? - one way or another, we really need to figure out how to show leadership on this now
- » **for this project, Jonathon says continue with creative schematic designs to get a trail past or around the pinch point

Meadow

- » bioswales would start in this zone, capturing parking lot runoff as well as the output from the roof gutter (which has a strange meandering design)
- » at some point the swales would also capture the

outflow from the building

- what we want to see next is experimental plots embedded in the schematic design
- will need to sit down with Diane, Sarah, Brenda, and others to take this next step

Soil testing

3 samples from each zone taken to a depth of 2-8 inches

- below this sampling depth they hit a hard layer; probably fill material and substrate
- basically the samples are just characterizing the topsoil, which is quite rocky
- the turfgrass itself is very shallow (about 2 inches)

existing organic matter content is unsuitable for desert plants

- but, at greater soil depth this might not be the case
- also, the existing soil chemistry may destabilize once the turfgrass is removed

general sense from the committee is we need to sample at greater depth

- the Red Butte Garden tests across the creek (by the green house) may be close enough to generally characterize the soil on the Williams side
- scientists on campus also have deep corers (augers) we may be able to use
- leaving soil exposed to visualize the soil profile would be a fantastic educational opportunity

Research Questions

Which features get the most usage by people? How do these features influence connections with the environment?

- The missing population from our baseline data is building occupants. As we look to survey and assess their responses, we need to keep in mind that 600 of the 1,100 building occupants will be vacating by the end of the calendar year (Goldman Sachs). The path of least resistance will be to focus on the other 500, who can be accessed via Jonathon's master e-mail list. Sarah and Matt will coordinate on developing a building inhabitant survey.

What are energy use implications of the goals of this project?

What are the impacts of changing landscapes on wildlife prevalence, diversity, etc.?

Which plant species are the most successful on site, and which volunteer species emerge and do well? Which species fail? How should we monitor invasive species?

- Plant establishment
- Seed mixes
- Maintenance - should become more seasonal; there will be a need to do ongoing weed control; we may be able to involve students in doing this work, but there will be questions about accessibility and some need to carefully language the nature of the space (i.e. a research landscape rather than an outdoor classroom)

Do landscape elements designed to reduce runoff and increase infiltration work as intended?

Can changing the sub-surface and overland flow have an impact on the stability of the bank and the rate of slope failure?

The assumption is that fertilizer and pesticide application harms the creek. How do landscape alterations change this?

Plant lists

Two lists: one specifically for the bioswales, another for the rest of the landscape area

Bioswale plants

- What do we want to experiment with? Who's input do we need? Christine, Sarah, Jason Draper, Diane…

Even with recommended plants, there really is very little research about how they perform in swales

Sarah has an expanded list that includes aesthetic considerations

- We want input about responses to the aesthetic of the swales as well as their function

Water quality

- it is of keen interest that the roof runoff is separate from the parking lot runoff; a lot of research potential on site

Signage

- What topics are getting signs and what are they telling us?
- Do we want a narrative movement of signage, e.g. a set route that follows a series of educational signs? (not a clear answer from the committee)
- Educational topics
  - RBC/watershed health
  - Bioswales/green infrastructure
  - Landscape lab – site of ongoing research
  - Plants
  - Wildlife
  - Waterwise landscapes
- **Student preferences for signs (ranked in order) (from Matt Brownlee's study)

  1) Macro-level view of the area (maps)
  2) Route finding
  3) Information about natural areas
- Put signage on the trees: genus, species, etc.
- Should match the new identification signs that Sue's sign shop is currently creating (for about 100 trees on campus)
- **There are questions about whether/to what extent legal and risk management will support signage: my understanding from our meeting was that educational signage is okay, but this needs to be clarified ASAP

Prolonged discussion about direct access to the creek

- this is a high priority for stakeholders and presumably for the University administration, but there are a lot of concerns about feasibility and liability
- the area around the loading dock could potentially facilitate direct access - Jonathon recommends focusing the most extensive "build out" in this area that is already immediately accessible to the building
- I believe Jonathon would support a bridge but would not want to pay for it (it's hard for me to believe there's not a University donor who would love to put their name on it…)

Site furnishings

- adjacent to the building (in the patio space) there could be moveable furnishings; the rest of the site would need to have fixed furnishings
- building occupants want picnic tables - ability to go eat lunch out on the site is a high priority for them
- interest in some furnishings near or in a bioswale - maybe a "casual" seat that is more like a boulder

Site lighting

- security and/or path lighting
- include these in cost estimates but they might not be approved by risk management
- Jonathon is updating their pole lighting, we want potential lighting to be consistent with this

Phasing Plan

Phase 1 (2016)

- Creekside, building-adjacent
- Entry, from Chipeta way to the sidewalk on the west end of the building

Phase 2 (2017)

- Meadow

Phase 3 (2018)

- Oak grove

** There is a question about how to phase the trail in such a way that it doesn't dead end. My feeling is that it should be phased by project rather than zone: landscaping phase 1, trail phase 2, parking lot phase 3, oak grove phase 4

Next steps

**follow up conversations

- » with Greg Lee re bridge and trail connection to Cottam's Grove and Red Butte Garden greenhouse area
- » with civil engineers re swale design and stormwater management from the new parking structure
- » with legal and risk management re trails, signage, and lighting
- » with Myron/Amy/Ruth re Red Butte Garden, negotiating with legal/risk, and direct creek access
- » with Sarah and Diane re plant palettes and pollinators
- » with research design team (Sarah, Diane, Brenda, others) re specific design considerations for experimental research
- » with Jason Draper, Lynn Berni, and Mike Brehm re permitting requirements for design concepts
- » building inhabitant survey

cost estimate

coordinate with new parking lot design

identify courses to integrate into planning, design, and research

present design development drawings to steering committee: February 2016

integrate committee input into final deliverables

- » finalize document
- » finalize design development plans

DESIGN PROCESS RECOMMENDATIONS

APPENDIX D

Many aspects of the design and planning process were new to the University of Utah, including the revitalization and reintegration of Red Butte Creek to the campus, the participatory design process, and the creation of designed experiments.

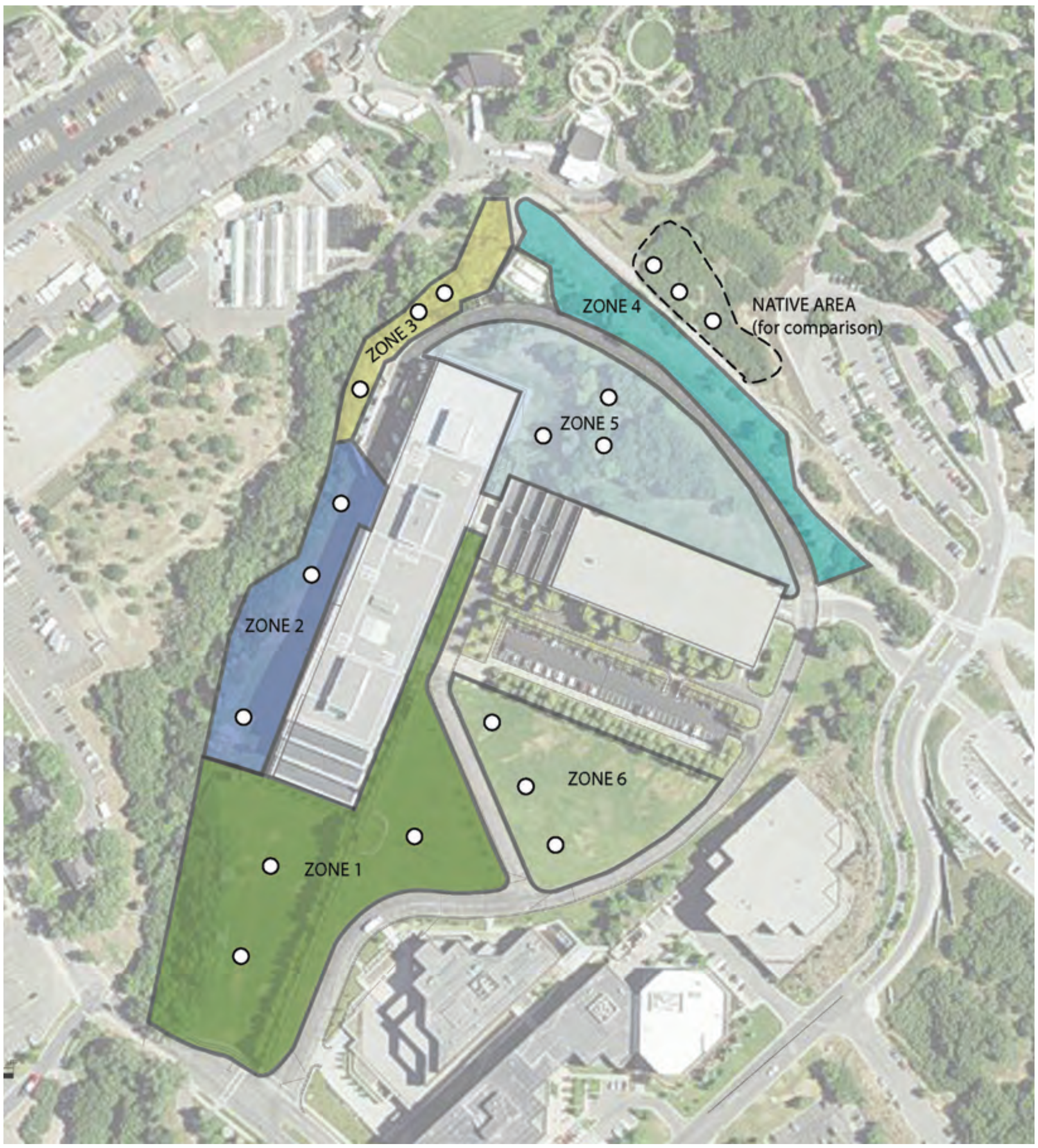
The committee and other members of the University and local community have voiced their support for continue this type of work throughout the University of Utah campus. In order to assist those engaged in future projects, we include here recommendations from the committee regarding the design and planning process at the Williams Building.

Prior to commencement of any new project along Red Butte Creek:

- Establish and prioritize goals for the project.
- Define and refine research questions.
- Develop a clear decision-making process.
- Establish a project decision maker with final approval on design decisions.
- Limit the number of committee participants.
- Establish stakeholder representatives for the various groups interested in the project, choose from these representatives to sit on the committee and report back to their respective departments.
- Ensure that faculty members have committed sufficient time for involvement in the project so that design can proceed on schedule.
- Provide the names and roles of each committee member to the designers before the kickoff meeting.
- Begin preliminary exploration of permitting and ADA requirements prior to engaging designer.
- Consider engaging designers/planners prior to project commencement to assist in defining the scope of the project and to assist in choosing a site that will best meet research needs.

SOIL ANALYSIS

APPENDIX F



SITE DRAINAGE ANALYSIS

APPENDIX G