1.0 INTRODUCTION

Salt Lake City's urban creeks and their associated riparian corridors are unique and important natural resources. To recognize the importance of these resources, Salt Lake City (the City) passed a Riparian Corridor Overlay Zone (RCO) ordinance on July 22, 2008. The RCO ordinance establishes restrictions and provisions for land uses occurring within 25, 50, and 100 feet of any above-ground city stream channel. In conjunction with passage of the ordinance, the City Council authorized the Salt Lake City Department of Public Utilities (DPU) to conduct stream corridor studies to assess baseline conditions on the above-ground portions of City, Emigration, Parleys, and Red Butte Creeks within City boundaries. This Riparian Corridor Study (RCS) Management Plan document presents the results of the baseline assessment of the Red Butte Creek riparian corridor, describes the desired future condition of the corridor as determined from public and stakeholder input, and identifies opportunities for improvement projects within the corridor.

Riparian Corridor Study and Management Plan Goals

The City has identified four primary objectives of the Red Butte Creek RCS as follows:

- to assess existing stream and riparian vegetation conditions;
- to determine desired future conditions;
- to identify opportunities for restoration and remediation of the Red Butte Creek corridor; and
- to use the information, data, and maps developed during the study to inform planning, permitting, and administrative processes of the RCO ordinance.

In addition to these objectives, specific purposes of the RCS public outreach process include the following:

- to elicit community and stakeholder participation,
- to identify public values and concerns, and
- to communicate results of the study for public awareness, education, and support.

The Red Butte Creek RCS and public outreach process is separate from but related to the previously completed RCO ordinance public outreach process. The RCS is intended to provide critical information that will guide the implementation and permitting aspects of the ordinance but is not intended to result in changes or revisions to the ordinance.

Study Area

In addition to the Red Butte Creek riparian corridor described in detail in this document, the complete DPU study also includes assessment of the above-ground portions of the Emigration Creek, Parleys Creek, and City Creek riparian corridors within City boundaries (Figure 1.1). The overall study is being completed in two phases. The studies on Emigration and Red Butte Creeks are being completed as the first phase of the project, from fall 2008 through fall 2009; studies on Parleys and City Creeks are being completed as the second phase of the project, from spring 2009 through spring 2010. More detailed information on all four of the riparian corridor studies can be found by accessing the DPU website at www.slch2o.com.

Importance and Functions of Riparian Corridors

Streams and riparian areas are unique, rare, sensitive, and highly important elements of the landscape. Riparian corridors, which encompass in-stream, riparian, and adjacent terrestrial habitats, function as complex interdependent ecosystems (Figure 1.2). The size, shape, flow regime, and bed material

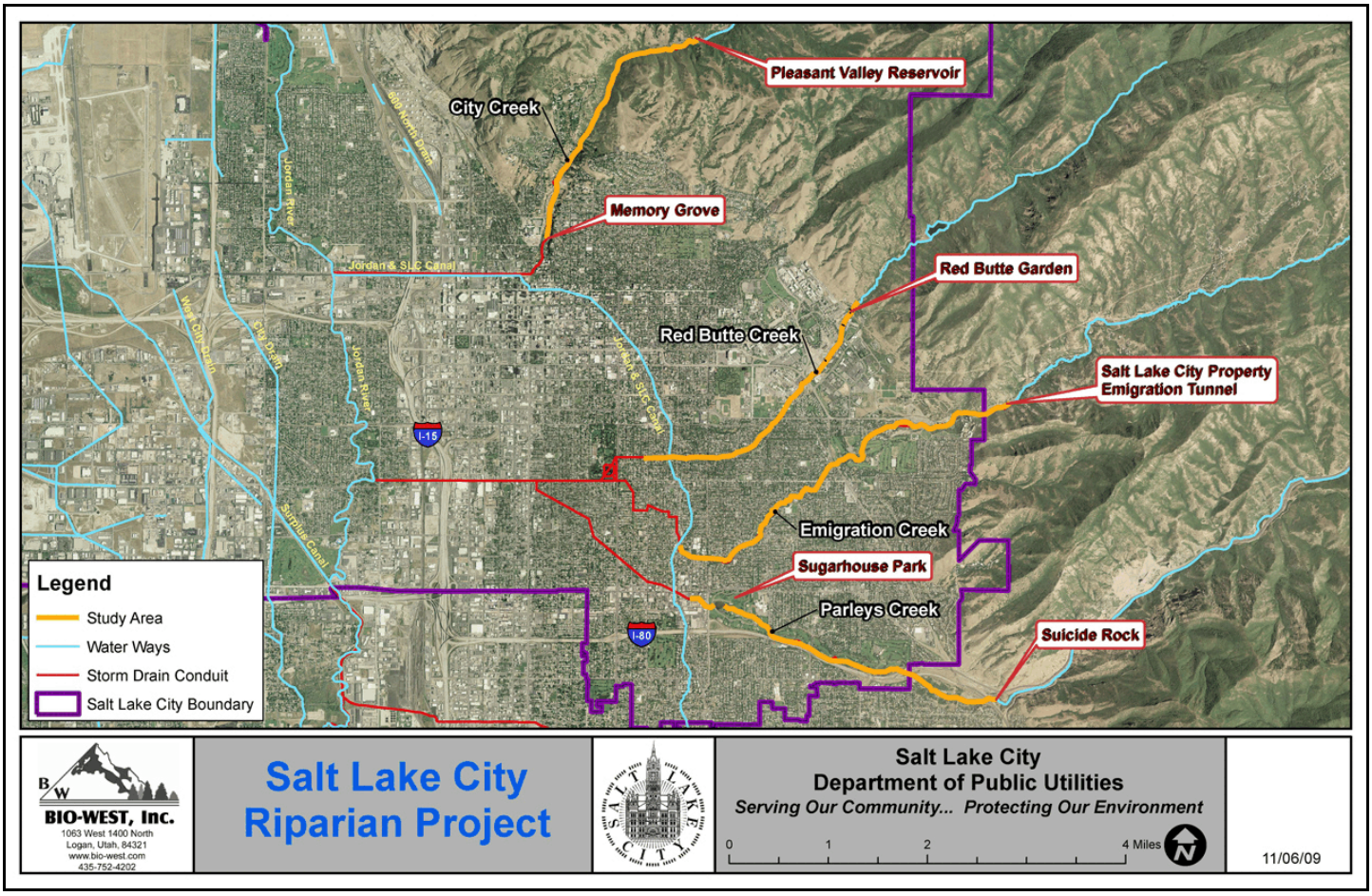


Figure 1.1. Emigration, Red Butte, Parleys, and City Creeks study areas.

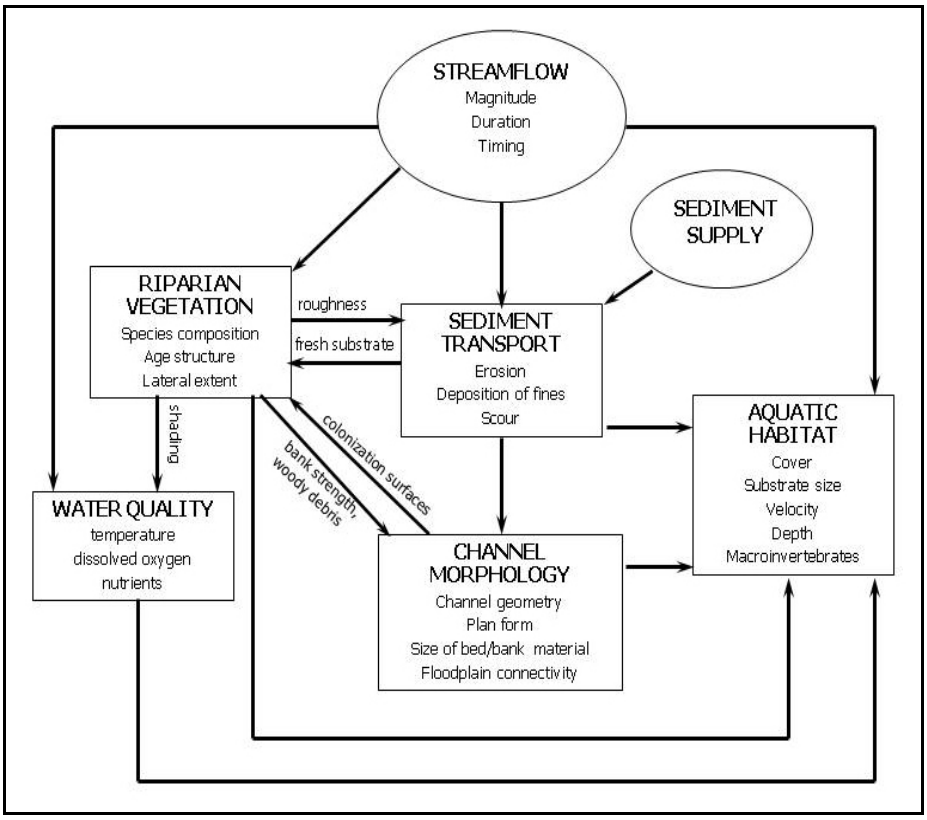


Figure 1.2. Schematic illustration of major interactions among riparian corridor resources and processes.

characteristics of the stream channel influence the amount, type, and distribution of vegetation on the streambanks. In turn, the condition, density, and composition of streambank vegetation communities influence the size, shape, and stability of the stream channel (Simon et al. 2004). These reciprocal influences operate through a variety of mechanisms including streambank shear strength, soil moisture content, flow resistance, bank steepness, flooding dynamics, erosion, and deposition.

Because of the complexity of riparian systems, alterations to any single component of the system can have positive or negative effects on multiple other components of the system. In healthy riparian corridors, stream channel processes such as flooding, meandering, erosion, and deposition provide colonization surfaces and moisture to support diverse, healthy riparian vegetation communities. In turn, healthy riparian vegetation communities provide streambank stability, shading, and woody debris inputs to support diverse, healthy aquatic communities.

Riparian areas occupy only a small proportion (less than 3%)

Riparian Corridor Definition

There is no universally agreed upon scientific definition of the term "riparian;" however, the term is typically used in modern scientific literature to describe the transitional area located between aquatic (in-stream) and upland habitats. Riparian plants that occupy this transitional area are typically adapted to conditions that are periodically wet and periodically disturbed by flood events.

Within the legal framework of the City's RCO ordinance, the term "riparian corridor" is defined as the area within 100 feet horizontally on either side of the annual high water level (AHWL) of above-ground streams (Figure 1.3). Depending on the stream channel and streambank conditions at a specific location, the legally defined riparian corridor often includes upland fringe and developed stream-side areas in addition to those areas that would be considered "riparian" based on the scientific definition. Within the City's RCO ordinance, the term "stream corridor" is defined as including the active stream channel as well as the 100-foot riparian corridor on each side of the channel. Therefore, the total stream corridor width equals 200 feet plus the width of the stream at high water, which varies depending on the specific location along the stream channel. The Red Butte Creek RCS addresses conditions within the Red Butte Creek stream corridor according to this definition.

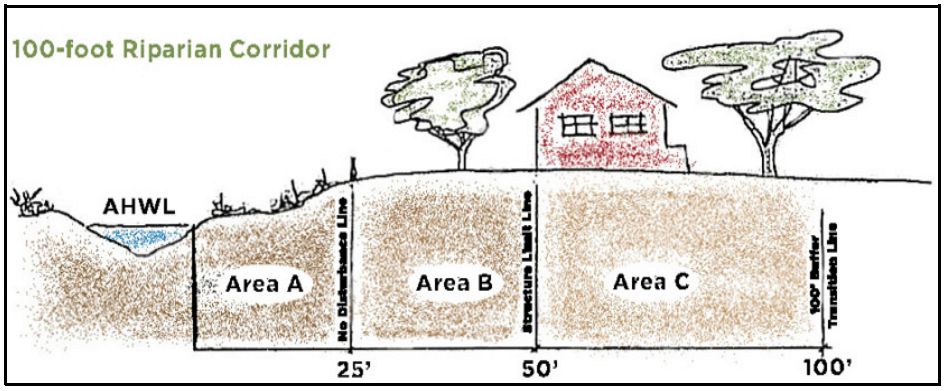


Figure 1.3. One hundred-foot Riparian Corridor Overlay Zone ordinance riparian corridor.

of the land area of Utah (USU 2003) and comprise about 1.2% of the land area of Salt Lake City. Despite their small size, riparian corridors serve a variety of important functions within the landscape, as discussed below.

Habitat for Mammals, Birds, and Fish

The ecological role of riparian zones is disproportionate to their small size. In Utah approximately 75% of the state's bird species rely on riparian habitat (USU 2003), and in the western United States up to 80% of all mammal and bird species rely on riparian zones for some part of their life cycle (Krueper 1993). The habitat importance of Red Butte Creek and the other above-ground stream corridors in Salt Lake City is enhanced because these streams lie close to the Great Salt Lake, an ecosystem of hemispheric significance in terms of providing resting, staging, and nesting habitat for migratory bird populations. Much of the value of riparian zones can be attributed to the fact that moisture and nutrients accumulate in these low-lying areas, leading to a greater diversity and density of plant communities. Healthy riparian corridors also support multiple structural layers of vegetation, including understory, shrub, and canopy layers that further contribute to habitat complexity (USU 2003).

Shading and Water-Temperature Control

Healthy stream-side vegetation provides a canopy that insulates the stream from the potentially harmful effects of excessive solar radiation. When water gets too warm, its oxygen-carrying capacity is reduced, which can harm fish and aquatic insect populations. Therefore, intact tree and shrub cover along streams, such as Red Butte Creek, is important for water quality. Shaded riparian areas also provide a cool, pleasant environment for City residents seeking refuge from summertime heat. Depending on how steep the streambanks are in a particular location, the shading function may be provided by moisture-dependent plants alone or by a combination of these plants plus the plants growing in adjacent, drier locations higher up on the banks. Therefore, even in areas where streambanks are steep and active floodplain surfaces are limited, the condition of the broader "stream corridor" (as defined in the RCO ordinance) is relevant to the shading and water-temperature control function.

Aesthetics

In arid Salt Lake City, the relatively lush, green, tall vegetation within riparian corridors is visually distinct from the remainder of the landscape

and has a unique aesthetic value. The sound of flowing water is also pleasing and calming. Because riparian corridors have these aesthetic qualities, people gravitate to these areas to have picnics, go for walks, and find quiet respite from the urban landscape. The aesthetic function is commonly highlighted as a valued amenity of properties located along stream corridors in the City.

Recreation and Open Space

Many of Salt Lake City's parks and open-space areas are located along riparian corridors. These areas function as important pockets of green space within an otherwise urbanized city environment. They provide opportunities for residents to experience and learn about the unique, natural processes and ecology of riparian corridors, as well as opportunities for both active and passive recreation.

Floodplain Storage and Flood Damage Reduction

Well-vegetated, pervious streambanks and low-lying floodplain surfaces act as sponges that absorb snowmelt and flood water and can reduce downstream flooding. Intact riparian vegetation also slows flood-water velocities and dissipates erosive energy. Floodplain and pervious streambed areas enable recharge of springtime runoff water into the ground, providing a source of streamflow later in the year during the dry summer months (Montgomery 1996). Because much of Red Butte Creek within Salt Lake City has a naturally steep and entrenched shape, the extent of flat, hydrologically connected floodplain surfaces is limited relative to flatter-gradient alluvial rivers. Nevertheless, some floodplain surfaces are present, particularly in areas where the channel width has not been confined by fill, bank stabilization, or channel-straightening activities. These areas of the riparian corridor provide some level of flood storage and groundwater recharge, while these functions are missing in areas where the creek has been piped or lined with impervious concrete.

Travel Corridors and Connectivity

The linear nature of riparian corridors makes them natural

travel routes for fish, birds, mammals, and other aquatic and terrestrial species. In Salt Lake City, the corridors provide a longitudinal connection between habitats in the mountains and habitats in the valley.

Organic Matter Inputs

Well-vegetated riparian corridors provide a supply of leaf litter and woody debris to the stream channel and aquatic environment. In small streams where photosynthesis is typically less significant, these organic matter inputs supply the primary source of energy and nutrients for aquatic insects and fish (USU 2003). Snags, branches, and leaf litter provide important cavity habitat and cover for birds and other terrestrial animals that use streambank areas, while woody debris jams within the stream channel add to aquatic habitat complexity and provide cover for fish.

Filtration of Sediment and Pollutants

Where a buffer of vegetation, especially tall grass or dense shrubs, is present along streambanks, the vegetation is able to physically trap sediment and associated pollutants conveyed in runoff from upland areas (Montgomery 1996). Vegetation communities with high stem and root densities are especially effective in this function. Well-vegetated floodplain surfaces serve a similar filtration and trapping function when they are inundated during flood events and can reduce the amount of sediment and pollutants entering downstream receiving waters. Vegetation can also reduce pollutant loads via biological uptake of nutrients and other chemicals attached to runoff.

In portions of the City's riparian corridors, this filtration function is "bypassed" to some extent because much of the storm runoff enters the creeks in a concentrated fashion through storm drain pipes. However, a significant amount of runoff still enters via the streambanks, and water that exits storm drain outfalls often flows along streambank areas for some distance before reaching the main stream channel. Therefore, healthy streambank vegetation positively influences water quality even in an urban storm water runoff setting.

Streambank Stability

Healthy vegetation communities add significantly to the strength and stability of streambanks. Vegetation protects the underlying soil from erosion due to raindrop impact or concentrated runoff. Roots add tensile strength to the soil and can anchor the soil to more resistant underlying soil or rock layers. Woody stems and trunks impart resistive strength that protects against lateral bank scour during high-flow events. Streambank vegetation also increases surface roughness, which helps dissipate energy and reduce flow velocities (Gray and Sotir 1996). Woody plants and plants with dense, deep root networks are especially valuable in terms of streambank stability.

Storm Water and Irrigation Water Conveyance

Within the developed portions of Salt Lake City, most of the runoff generated from rooftops, roads, and other impervious surfaces during storm events is conveyed first into curbside gutters, then into storm drains and underground pipes, then into the City's streams, including Red Butte Creek. The City relies on these natural steam channels to convey storm water to downstream conduit and detention facilities in a safe manner that minimizes the risk of damage to infrastructure from flooding. The Red Butte Creek channel is further used to deliver water to points of diversion for irrigation purposes per established water rights.

Public Outreach and Involvement

The preparation of the Red Butte Creek RCS Management Plan has required extensive public and agency involvement activities throughout the 15-month planning process. The planning process included a broad outreach element that emphasized public and agency involvement in identifying desired future conditions for the creek. The overall goal of the public outreach element was to elicit community and stakeholder participation and identify public values and concerns associated with the riparian corridor, including environmental issues, aesthetic values, private property interests, public lands access, water quality, wildlife habitat, and flood control. In addition, it is the intent to effectively convey in this plan the results of the study for public awareness, education, and support.

Several methods of public and agency involvement were used to gain insight into the concerns of those potentially affected by this plan. These methods included facilitation of public workshops, formation of a stakeholder committee, and development of an interactive web page to disseminate information. Each method is described in more detail below.

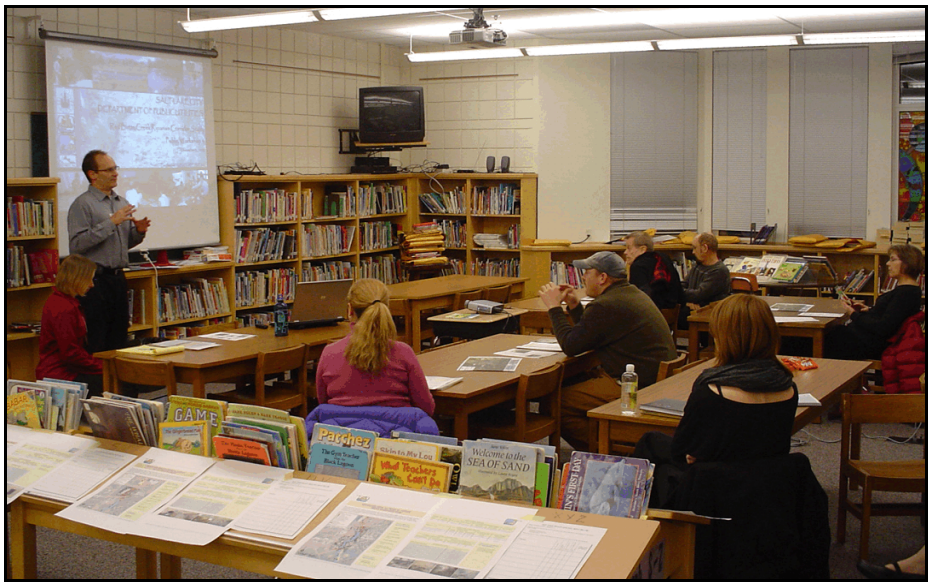
Public Workshops

A series of four public workshops were conducted during the planning process to solicit and obtain public input and to share the results of project activities. These public workshops consisted of both a "formal" presentation and question-answer period and an "informal, open-house" period whereby individuals could freely participate. Each workshop was held at a convenient location near the study area, and both City and consultant staff were on-hand to answer questions and record input. Each workshop was advertised on the City's web page for the RCS projects and at local media outlets. Workshop flyers were posted around the City at public locations and postcard notices were distributed to those individuals on the project mailing list.

The first public workshop was held on October 28, 2008, at East High School. The first workshop allowed public and agency participants the opportunity to identify the issues, concerns, and opportunities that exist relative to the project study area. Maps and photographs of the study area were available to orient participants and elicit their site-specific input. An overview of the planning process was presented, including specific public outreach and baseline condition assessment activities, and participants were educated about important riparian corridor functions. Participants were encouraged to fill out a workshop response form, as well as a private property access permission form for data gathering. Approximately 16 individuals attended the first workshop.

The second public workshop was held on February 19, 2009, at Uintah Elementary School. The second workshop focused on reviewing baseline stream and vegetation assessment results and initiating development of a vision statement for the plan. Maps, graphs, and photographs of the study area that identified resource locations and conditions were presented, along with detailed handouts, to help inform interested participants. An update of the planning process timeline was also presented. Comments from participants on the project vision statement were solicited on the workshop response forms that were provided. Approximately 24 individuals attended the second workshop.

The third public workshop was held on May 14, 2009, at Uintah Elementary School. The third workshop was a forum for presenting and discussing the range of variable riparian corridor improvement projects and presenting and discussing the draft vision statement for the management plan. Maps, photos, and schematic drawings



"Our goal is that this study will use a collaborative approach to information exchange, joint information gathering, consultation, and consensus in a way that will promote legitimacy and transparency, encourage creative problem-solving, and support a timely implementation."

–Mayor Ralph Becker's goal for community involvement in the Riparian Corridor Study Management Plan projects

were used to present the proposed types of projects and provide guidance regarding the appropriate scale and locations for the projects. Summaries of the proposed projects were provided in workshop handouts. An update of the planning process timeline was presented and opportunities for participants to comment on the proposed projects were provided. Participants were asked to help prioritize projects and specifically asked to comment on the draft vision statement provided on the workshop response form. Approximately 21 individuals attended the third workshop.

The fourth and final public workshop was held on December 9, 2009, at Uintah Elementary School. The fourth workshop provided an opportunity for participants to comment on the Draft RCS Management Plan document. An overview of the plan document was presented and opportunities for providing comments were discussed. Comments from participants were encouraged. Approximately 10 individuals attended the fourth workshop.

Riparian Corridor Study Subcommittee Meetings

The RCS Subcommittee was formed to provide guidance to DPU throughout the studies and broadly represent the various stakeholders who have an interest in the planning process. The Subcommittee helped identify issues, evaluate data and data collection methods, develop the vision statement, recommend and critique restoration projects, and review chapters of the plan document. Subcommittee members were solicited by the City to participate in the project.

Members of the RCS Subcommittee included the following:

- Red Butte Creek Residents
- Emigration Creek Residents
- Hogle Zoo
- Red Butte Garden and Arboretum
- Salt Lake City Public Utilities Advisory Committee
- Salt Lake City Parks
- Salt Lake County
- Salt Lake Valley Health Department
- Trout Unlimited
- University of Utah
- Utah Open Lands
- Utah Rivers Council
- Utah Department of Environmental Quality
- United States Veterans Administration Medical Center

The RCS Subcommittee convened a total of five times during the 15-month planning process.

Interactive Web Page

Salt Lake City DPU dedicated a page on their web site specifically for the RCS projects (www.slcgov.com/utilities/ud_riparian_corridor_stream_study.htm). A history of the RCS project was provided on the web page, along with information related to the RCO ordinance. A map of study area streams could be downloaded by web site visitors, as could all information disseminated at each of the public workshops including presentations, handouts, comment forms, and meeting announcements. Web-based public comment forms and property-access permission forms were also made available on this web page.

Management Plan Approach

The planning process for the Red Butte Creek RCS Management Plan involved the coordination and cooperation of members of the public, state and local government agency staff, and consultant team planners and resource scientists working together over a 15-month period to complete this document.

Those involved helped perform key activities during the planning process including public and agency involvement, baseline resource inventories and analyses, vision statement formulation, and improvement project identification. Figures 1.4 and 1.5 provide an overview of the Red Butte Creek RCS planning process organization and timeline.

Initial steps during the planning process focused on compiling relevant and available resource data, topography, mapping layers, and aerial photography. A reconnaissance-level field assessment was performed early in the planning process to help determine appropriate data collection efforts and divide the creek into specific study reaches. Once preliminary reaches were defined and data collection protocols established, field work was conducted to characterize stream channel, streambank, and riparian vegetation conditions throughout each reach. Relevant data for both the stream condition and vegetation condition assessments were collected and assembled in a Geographic Information System (GIS) format.

Desired future conditions for each study stream were determined primarily through public outreach and stakeholder participation efforts. Historical data and trend assessment results were used to help define realistic, reach-appropriate riparian vegetation and stream condition

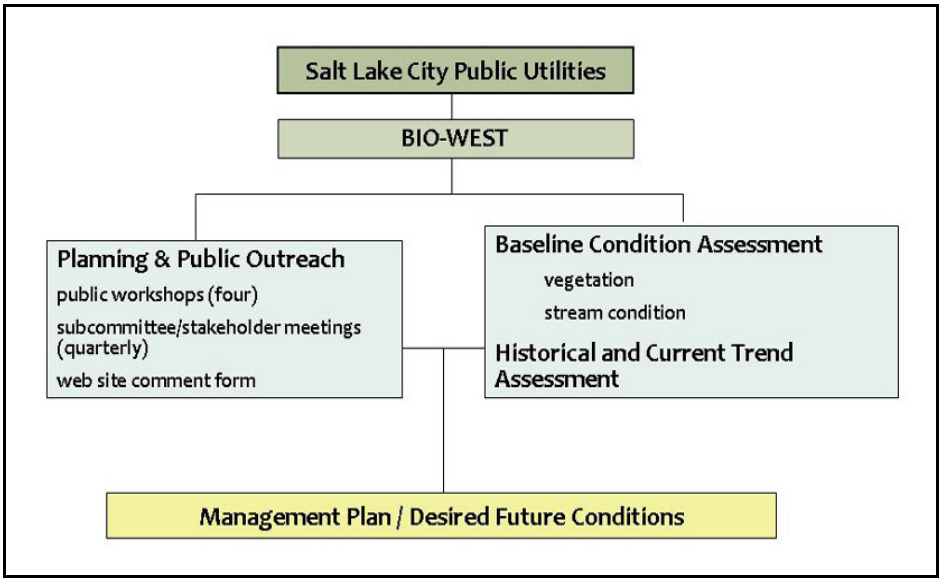


Figure 1.4. Organizational Chart for the Salt Lake City Riparian Corridor Management Plans.

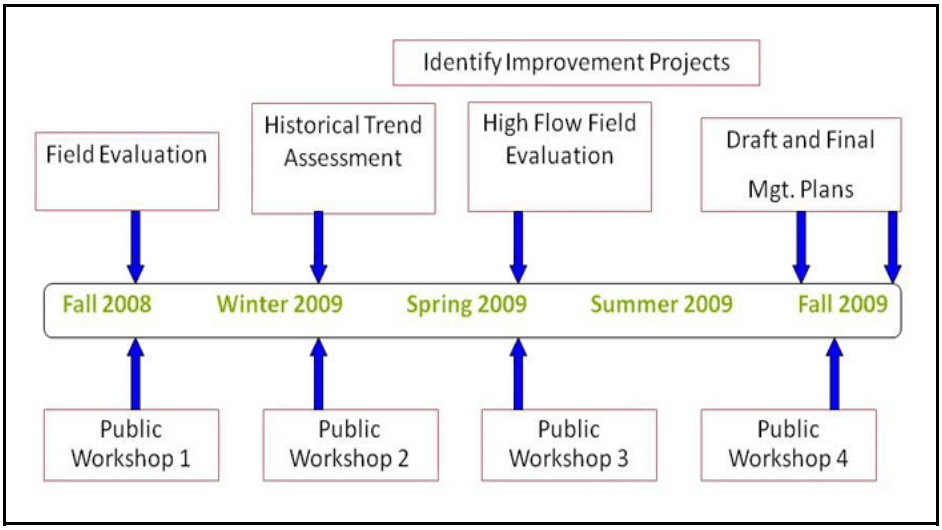


Figure 1.5. Timeline of Salt Lake City Riparian Corridor Studies and Management Plans.

targets. Targets are focused toward achieving the specific riparian corridor functions identified as priorities during the outreach process. Desired future conditions were compared with existing conditions determined through the baseline assessment process to assess how well riparian functions are being achieved in the different reaches. Appropriate types of improvement projects were identified for each reach, and costs for the different types of projects were estimated. Specific projects were then prioritized and ranked based on costs, benefits, and public input.