



OUR RIVER
OUR FUTURE
COMMUNITY DEVELOPMENT INC.

BEST PRACTICES FOR RIVERFRONT COMMUNITIES

A guide for consistent, but flexible, management of the Jordan River environment.



JUNE 2013

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Produced with the assistance of a Red Butte Creek Mitigation Grant through the Utah Division of Water Quality.

PROJECT TEAM



Dear Jordan River Stakeholder,

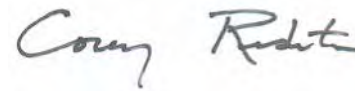
It has been an honor to serve as the first Chairman of the Jordan River Commission. In this day and age it is a marvel to witness a greater brotherhood of organizations and people from different backgrounds, various political leanings, and diverse perspectives coming together to share in a common vision of our river and its future. Within a few short years our efforts have been blessed with increased momentum and we recognize the important role that people like you play in this important cause.

I have come to realize that whoever first uttered the advice that, “You should never speak of politics or religion in polite company” surely did not consider how the topic of the Jordan River fit within that remark. I have seen elected and appointed officials from all levels of government and its various jurisdictions quickly set aside prior biases and grievances to work side by side and arm in arm on behalf of the river corridor. I have also witnessed the amazing corps of river enthusiasts, businesses, and volunteers speak of the Jordan River with reverence and labor with religious zeal to preserve its blue meandering beds and wildlife filled banks.

We have learned that the natural ecosystems of the Jordan River are as equally complex as are the issues that we are trying to address. The abundance and potential of the corridor is great as are the possibilities. Unlocking the potential of the Jordan River will undoubtedly mean different things to different people, but will require a basic framework of knowledge and association. What do you get when you put a fisherman, a biologist, an engineer, a bicyclist, a banker, and an elected official together may sound like the introduction of a clever riddle, but is a true indication of the collaborations that we as a commission value and that are necessary to foster true and meaningful river enhancement.

Our goal is to generate solutions to the growing Jordan River corridor needs by aligning our commission’s rich and diverse membership with existing and emerging best practices. We will also further explore and develop the regional collaboration needed to preserve and protect this natural wonder in the midst of continued

economic growth. Addressing these needs is essential if the Jordan River corridor is to thrive in this busy valley and our children are to be equipped with the skills that let them embrace the opportunities that lie ahead.



Corey Rushton
West Valley City Councilmember
Jordan River Commission Chairman



Corey Rushton
West Valley City Councilmember
Jordan River Commission Chairman



**A RESOLUTION IN SUPPORT OF
IMPLEMENTING THE BEST PRACTICES**

WHEREAS, the Jordan River is an urban waterway bordering 15 municipalities and three counties, with the potential to be a wonderful asset to the residents and visitors of region;

WHEREAS, greater Salt Lake region is an expanding urban area, in which open spaces for parks, trails and recreation are rapidly disappearing;

WHEREAS, the communities along the Jordan River have recognized the valuable asset that this urban waterway presents to their residents and visitors,

WHEREAS, the majority of local governments along the Jordan River have passed resolutions supporting implementation of the “Blueprint Jordan River: A Lake to Lake Vision,” a comprehensive three-county visioning process to restore a healthier and more attractive Jordan River corridor;

WHEREAS, the Jordan River Commission was created through an Interlocal Cooperation Agreement of the cities and counties along the Jordan River to implement the Blueprint Jordan River;

WHEREAS, the Jordan River Commission has developed a new set of tools, “Best Practices for Riverfront Communities” to help communities implement the goals of the Blueprint Jordan River, which includes strategies for land use, environmental restoration, recreation, stormwater management, and utility corridors;

WHEREAS, the Best Practices for Riverfront Communities identify practical considerations, local examples, benefits and “how to” instructions, as well as providing multiple tools to assist in implementation of the Best Practices at the local government level;

WHEREAS, incorporating the Best Practices for Riverfront Communities and implementing the vision of the Blueprint Jordan River at both the community and regional levels will improve the quality of life for all residents and visitors by restoring natural habitat and providing recreational opportunities for many years to come;

WHEREAS, the Jordan River Commission has no regulatory authority, and the Best Practices for Riverfront Communities document is designed to be a flexible tool that allows for local adaptation to effectively implement local priorities and to reflect individual community needs.

WHEREAS, the Jordan River Commission exists as a resource for local governments and other Jordan River Stakeholders to help with implementation through technical assistance, volunteer organization, grant writing, fundraising, lobbying, education, and community outreach.

NOW THEREFORE, BE IT RESOLVED,

That the Governing Board of the Jordan River Commission, hereby commits to support to implementation of the Best Practices for Riverfront Communities into its practices and decision making, and to encourage incorporation of the Best Practices into local government planning processes and land management practices by:

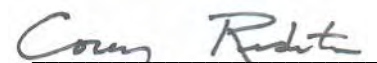
Enacting or modifying zoning ordinances based on the Best Practices for Riverfront Communities to ensure that any development within the Jordan River corridor is compatible with Blueprint recommendations;

Incorporating the Best Practices for Riverfront Communities into regular maintenance plans, programs, and practices for open space, recreational areas, and stormwater systems.

Participation in cooperative efforts to fund open space acquisition, trail development, and habitat restoration where practical;

Participating in ongoing regional efforts to implement the guiding principles and goals of the Blueprint Jordan River.

APPROVED and ADOPTED this 16th day of May, 2013 by the Jordan River Commission.



Corey Rushton, Chair






Date: May 16, 2013

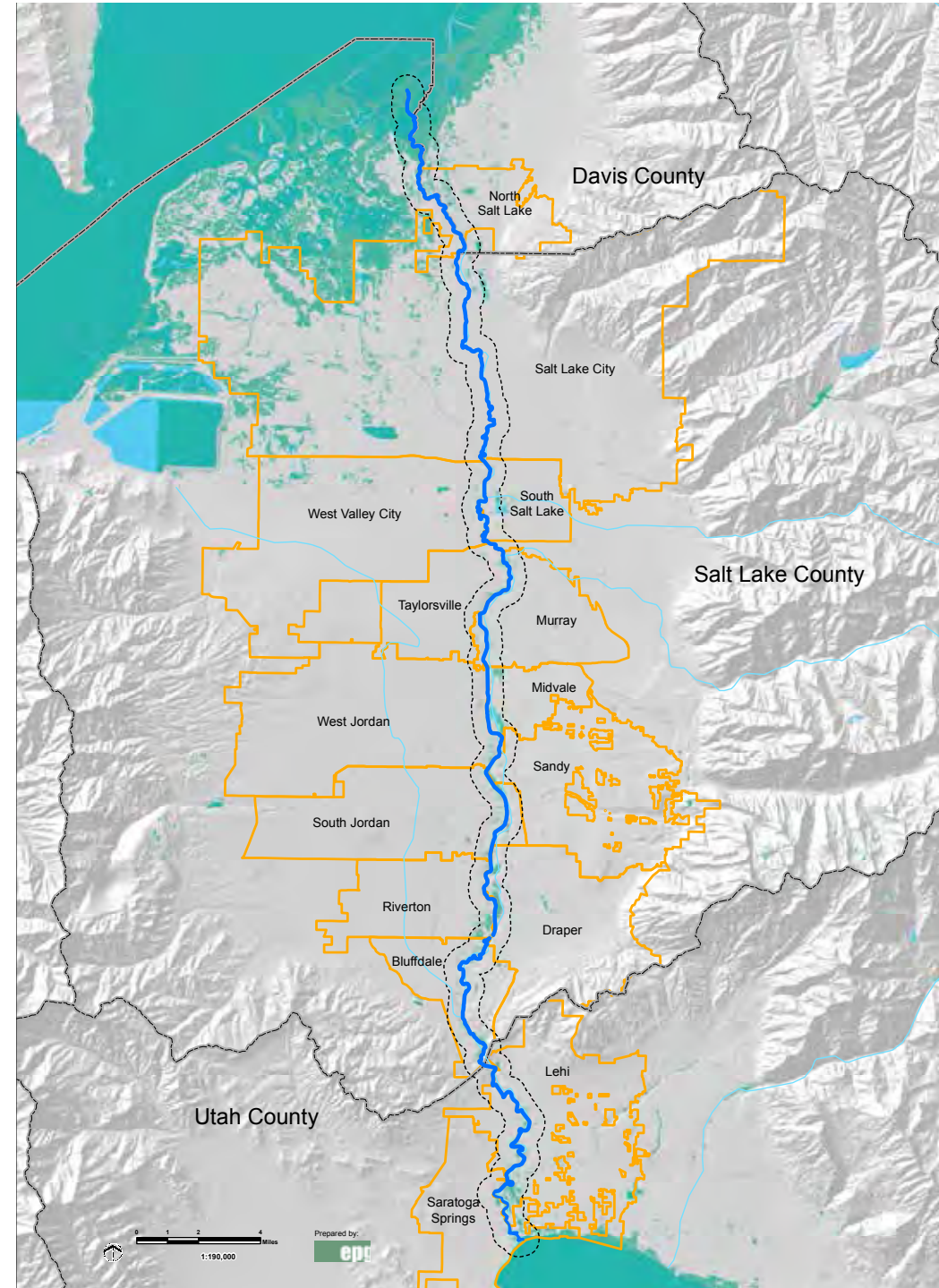


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LEGEND

-  Jordan River
-  Jordan River Study Area
-  River or Stream
-  Lake, Pond, or Reservoir
-  Wetland
-  Study Area Municipality
-  County Boundary



WE ALL HAVE A STAKE IN THE FUTURE OF THE JORDAN RIVER

The Jordan River corridor runs through 3 counties and 15 cities; from Utah Lake, through the Salt Lake Valley, and finally into the Great Salt Lake. Streams and rivers from the Wasatch and Oquirrh mountains feed directly into the Jordan River Basin. Thus, the Jordan River represents a unique 50-mile-long corridor of tremendous value—environmentally, recreationally, economically, and culturally—for all the communities through which it flows and for the entire Wasatch Front. Because of this physical and social interconnectedness, successful management and development of the river corridor requires close cooperation between government agencies, landowners, and river corridor users.

The Blueprint Jordan River is the community vision for the protection and enhancement of the river, completed in 2008. Land use policy statements within the document provide a framework to guide future efforts related to the Jordan River corridor and include:

Policy 1: All undeveloped land within the flood plain and land that has wetland or habitat restoration, creation, or preservation potential should be preserved as open space.

Policy 2: Areas that are planned for development that conflict with Policy 1 should be priority areas for land acquisition and protection.

Policy 3: Any land within the river corridor (i.e., within one-half mile of the river) that is not designated as “open space” or recommended for preservation in Policies 1 and 2 should be subject to the application of strategies for low-impact development and sustainable landscaping.

The Jordan River corridor is a lifeline that connects communities by providing many critical services such as mitigating floods, recharging groundwater, filtering pollution, providing important wildlife habitat, and offering recreational opportunities. The challenges that face communities along the river corridor such as water quality issues, noxious weed infestations, and flooding also connect them because issues that affect one community are likely to reverberate downstream and impact others. Both the benefits and the challenges require a collective approach that focuses on the river system as a whole. This best practices document and approach can assist communities in achieving their vision for preserving or enhancing the river corridor.

HEALTH, VALUE, AND QUALITY OF LIFE

Eighty percent of the U.S. population now lives in an urban or semi-urban setting, and many are disconnected from the natural world. A common belief among urban communities is that nature and the need for environmental restoration occurs “elsewhere” in areas far removed from human development. However, many key ecological processes, such as hydrological and energy flows, nutrient cycling, and plant-animal community dynamics, occur within urban limits. More importantly, experiencing nature in an urban context can foster support for ecological preservation by residents within their own community and has the potential to improve quality of life and health of urban and suburban residents. Exposure to nature and open space can relieve stress, enhance emotional and intellectual development, and form values in children. Protecting open space, as well as enhancing its quality, can increase our cultural heritage, provide spiritual and religious inspiration and a sense of place, and improve aesthetics and educational and recreational opportunities.



View of the Jordan River



Local Project Success:

*Walden Park (5400-5600 South) Murray City, Utah
Photograph by Nancy Monteith*

HISTORICAL PERSPECTIVES TO RIVER MANAGEMENT

The Jordan River once meandered freely in a large floodplain that was created by and responded to occasional intense high flow periods. Low lying areas near the river flooded and accommodated debris from the river. When the waters receded healthy habitat function remained. However, like other river systems near large population centers, agricultural practices and especially the expansion of urban areas have steadily taken their toll on the quality and function of the river.

Over the last 150 years residents of the valleys have sought to control the Jordan River by channelizing it, diverting its waters, controlling its flow, and altering its floodplain for both agricultural and urban uses. These alterations of the river and its ecology have not only degraded the system overall, but they have reduced the capacity of the river and its floodplain to attenuate and mitigate future flood events. This degradation of the system effectively increases the probability of significant damage to community facilities, infrastructure, and residences that have spread into the floodplain over generations. The National Flood Insurance Program (NFIP) delineates a flood area that has a statistical chance of flooding every 100 years. In reality, larger floods impacting areas outside the FEMA floodmap have happened along the river corridor about every 30 years. Communities responded to the floods of the 1920s, 1950s, and 1980s with focused efforts on straightening the Jordan River as an attempt to keep the floodwaters in the channel. As well intentioned as those efforts likely were, advances in the science of river management since these decades resoundingly point to the many flaws in this kind of management.

Several studies and plans have been produced for the Jordan River since the 1970s. These include a parkway master plan, a Jordan River stability study, a conservation report and several more. The studies included strong recommendations for recognizing the natural river meander corridor and designating open space activities in those areas meant to flood during extreme periodic events. These recommendations could enhance public health and safety, as well as techniques to minimize damage to expensive public and private infrastructure. The studies, however, have not been implemented in a comprehensive manner.

The Clean Water Act reauthorization of 1987 also helped community residents and leaders recognize the important benefits to the public in cleaning up our waterways for public health, safety, and recreation and included the benefits derived from healthy river ecology. Smart sustainable development policies that address today's stormwater practices, the built environment, and habitat preservation will prevent far more costly future emergency responses to the next flooding cycle.

A BETTER WAY

Very few of the original conditions that characterized the river many years ago still exist today. Humans have had an extensive impact, but there is still the possibility of achieving a balance. The opportunity of returning the river to pre-settlement conditions is unrealistic; however, the river corridor can be enhanced from its current state.

All across the country, vibrant and progressive communities are recognizing and investing in the assets of their river corridors. In Utah, the communities along the Jordan River have mutually begun to focus their efforts to implement innovative land use and development practices, choosing to lead the way to a better future. The best practices offered in this document will help manage and improve the river environs by providing multiple choices for each community to customize what will be their own individual approach to establishing a healthy riparian and meander corridor. Communities are encouraged to adopt proactive and sustainable river corridor development policies that include:

- Addressing better ways to build within the river corridor
- Enhancing open space habitats
- Providing compatible recreation opportunities
- Improving stormwater practices

COMMUNITY BENEFITS

The Jordan River corridor has tremendous value as a recreational, economic, and cultural resource to Wasatch Front communities, as well as being an important habitat for native wildlife. Best practices for river corridor management offer ways to enhance and maximize this resource for the benefit for local communities. Improving the natural river function through protection and enhancement of the river will also create a system more resilient to occasional flooding. Quality open space also enhances neighborhood and community economic value, and provides a lure to people and businesses. In short, there are myriad ways that improved river corridor management can enhance the quality of life when the river is properly recognized for the incredible value that it holds.



*Local Project Success:
Great Salt Lake Audubon - project implementation,
Utah Reclamation Mitigation Conservation
Commission (10600 South)- owner
Photograph by Keith Johnson*

BEST PRACTICES FOR RIVERFRONT COMMUNITIES

The goal of this document is to provide a set of tools and guidelines, or best practices to enable communities to create consistent, but flexible, management of the Jordan River corridor. A best practice is a method, practice, or process or activity based on sound environmental and engineering knowledge. Best practices continue to evolve as new and better planning methods are discovered. The intent of the best practices is to strike a balance between the need for consistent land development and management approaches along the length of the river and the desire for local flexibility. The best practices will provide tangible strategies and tools that counties and cities can use to address issues related to preservation and development in the river corridor. The best practices are categorized by the issue they target such as land use, environment, recreation, stormwater, and utilities. Each best practice includes its benefits, implementation requirements and relative costs, approach to installation, local project examples, and resources for additional information.

The intent of the best practices is for the counties and cities to use these as guidelines to develop their own policies and ordinances. It aims to provide an easy to use and accessible best practice toolbox for community leaders and managers who are stewards of the Jordan River. Stewardship of a regional resource requires integration of management practices across disciplines, departments, and communities to improve the quality of the Jordan River.

THE PROCESS OF DEVELOPING THE BEST PRACTICES

Because of the physical and social interconnectedness, successful management and development of the river corridor will require close cooperation between government agencies, landowners, and river users. Community stakeholders identified issues and challenges and helped in the development of best practices.

The document development included:

- Conducting one-on-one conversations with planning, parks, and public works staff
- Facilitating workshops with community stakeholders to identify content
- Creating a flexible toolbox of best practices
- Providing opportunities for the public to give feedback on the documents
- Developing education and outreach tools for the community to understand how to apply the best practices

HOW TO USE THIS DOCUMENT

This document is organized around the relationship of the land context and the best practice categories. The Jordan River Graph on page 5 illustrates this relationship. Each vertical section or column of the graph represents a particular area beyond the river, which may vary in size but has some homogeneous functions and characteristics. This document is organized around these four land use zones/transects, including river, natural environment, manicured open space, and the built environment. In addition, there are five land planning and management objectives (i.e., land use, environment, recreation, stormwater, and utilities) with associated best practices, organized in the graph horizontally according to their relationship with the four land use zones/transects. The vertical and horizontal axes provide two different ways to access and understand the toolbox. They allow you to think about both the existing land use conditions in context with the management objectives or goals you are trying to achieve.

The Jordan River Best Practices should also be considered within the context of other regulations and permits.



The Jordan River parkway trail parallels the Jordan River through both natural and more developed areas.

How to use this document

The graph on the facing page illustrates the relationship of the land use context and the best practice categories. This graph provides two different ways to access the toolbox.

Consider both the **context** or existing land use conditions and also the goals or **management objectives** you are trying to achieve.

CONSIDER THE “CONTEXT,” OR CATEGORY OF DEVELOPMENT

This toolbox provides best practices for conservation or development within ½ mile of the river. There are four types of land use zones the best practices address. They include:

River

This is the active river corridor. The river bottom is owned and managed for public benefit by the Utah Department of Natural Resources Division of Forestry, Fire, and State Lands. Any work done within the bank-to-bank ordinary high water line of the river needs to be directly coordinated with, and permitted by, Forestry, Fire, and State Lands. For this reason, the practices included in this document do not address the river but rather areas up to the river bank.

Natural environment buffer

This is the area adjacent to the river that is left in an undeveloped state. This area is identified by its physical characteristics rather than land use designation or protection. The width of this buffer can vary from non-existent to several hundred feet wide. These lands adjacent to the river provide valuable protection of river banks, mitigation of floods, and stability of the river. Parks and open lands managers, municipalities, and private owners can use the guidelines in this section to aid in the management of these areas.

Manicured open space or agriculture

Manicured open space along the river includes parks, golf courses, and agricultural lands adjacent to the river or natural areas. Open space in the vicinity of the river can act as a buffer between natural areas and development. These actively managed areas have potential to improve the overall function and quality of the Jordan River, including enhancing native vegetation and improving stormwater management. These improvements will not only enhance recreation and scenic value of the area, but also provide valuable ecosystem services. Parks and open lands managers, agricultural lands managers, municipalities, and private operators of recreation facilities can use the guidelines in this section to aid in the management of these areas.

Built environment

Much of the land within ½ mile of the Jordan River is developed. Residential, office, commercial, utility, and industrial land-uses are found in proximity to the river or the natural lands adjacent to the river. What characterizes developed areas is impervious cover and the generation of stormwater that poses both quality and quantity challenges. The Jordan River will benefit from retrofitting already developed areas and their infrastructure to improve management of stormwater, introducing new and improved maintenance practices, and enhancing community access to the regional recreation network. Both public and private developers, as well as, facility managers can use the best practices in this section to improve the Jordan River.

CONSIDER THE OBJECTIVES YOU ARE TRYING TO ACHIEVE

There are five types of land management goals that the best practices address. They include:

Land use

Land use and zoning tools play a critical role in shaping the character and physical development of local communities. Zoning codes, supported by the policies of a general plan, not only set the rules for development of land but also for the protection of important local resources such as aquatic, riparian, and upland habitat; scenic areas; and historic resources.

Environment

The Jordan River provides important habitat for many native wildlife species, as well as important stop-off areas and foraging opportunities for many migratory species. Implementing restoration projects that improve native species diversity, habitat quality and connectivity, and management efforts to control the spread of invasive species can enhance long-term sustainability of the river corridor as a functioning and healthy ecosystem.

Recreation

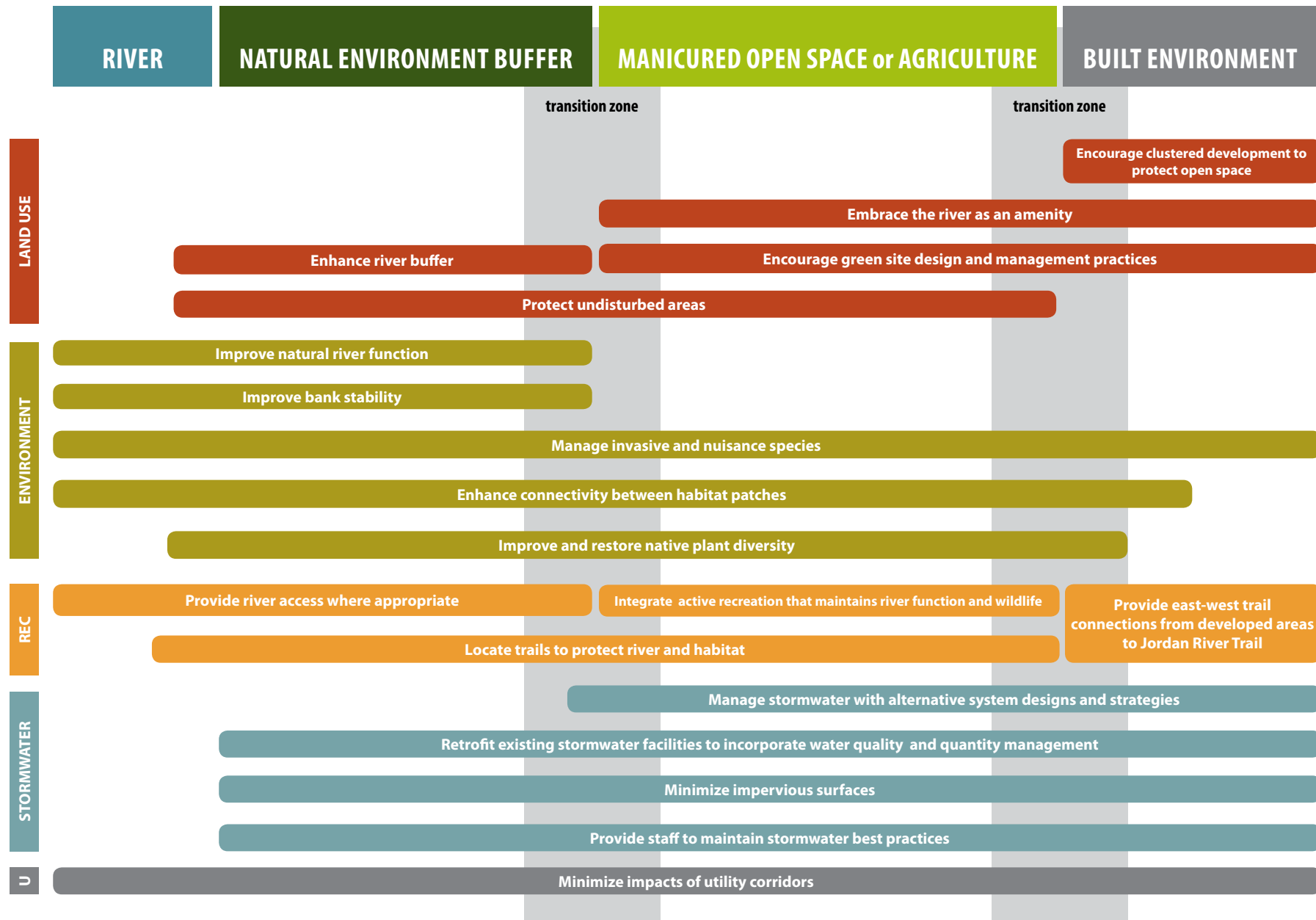
The Jordan River corridor is a regional recreation resource that provides all ages and abilities an opportunity to experience nature in the city and build support for river stewardship. Recreation facilities also have the potential to be developed in such a way that they contribute to a robust green infrastructure network that can mitigate negative impacts of development, contribute to natural habitat, and provide valuable transportation linkages.

Stormwater

Stormwater best practices typically include efforts to correct a water quality or quantity problem after it has been created by human activity and is consequently a last defense against pollution of the Jordan River. Other best practices, such as preservation of open space, can greatly benefit the quality of stormwater discharges to the Jordan River by preventing initial impacts.

Utilities

Several utility corridors intersect or parallel the Jordan River. These include pipelines, canals, access roads, power lines, etc. These corridors create opportunities for recreation, habitat, and maintenance access; but can also create challenges. Best practices can help balance utility operations with protection and enhancement of the river corridor.



The goal is to create an integrated system of practices that work together across the entire 50-mile Jordan River corridor, yet still provide flexibility for local adaptation.

LEGEND

- Land Use Best Practices
- Environment Best Practices
- Recreation Best Practices
- Stormwater Best Practices
- Utility Best Practices



*Local Project Success:
Ogden River Restoration Project, Ogden, Utah
Photograph by Ben Nadolski*

WHO CAN USE THIS DOCUMENT?

Elected and Appointed Officials

Elected and appointed officials have a significant influence on planning and zoning documents adopted by local communities and this provides tools and strategies for creating livable communities that embrace the river. Within this toolbox, there are best practices intended to improve the way parks, public works, and planning departments address green infrastructure and storm drainage. In addition, these tools can encourage development through the planning process to return runoff to the ground in ways that mitigate the reduction in quality and quantity of stormwater.

Public Works, Planners, and Parks Departments

Departments can influence city and county policy by providing information and potential direction to elected and appointed officials. This role is a general responsibility for all city and county departments, but the protection of the Jordan River can sometimes be negatively affected by the practices of the parks, public works, and planning departments. Understanding the overall context of the toolbox is important in achieving success with individual efforts in each department of each community and neighboring communities.

Homeowners, Landowners, Developers, Non-profits, and Farmers

Common practices by individual private property owners can also impact the Jordan River. Homeowners often deposit organic matter (e.g.: grass clippings, raked leaves or yard waste), in their gutters that eventually makes its way to the river. Landowners sometimes clear their property for future development, potentially increasing the spread of invasive species and sediment load into the storm drainage system. Developers may not be willing to set aside property that lies close to the river without an incentive. The work of non-profits can help preserve land and educate the community about river-related issues. Farmers, land owners, and land managers use fertilizer and pesticides to manage landscapes and may inadvertently pollute the river. Private landowners are often tremendous stewards of their land and this toolbox is useful in identifying new ways to strengthen this commitment. Additionally, raising public awareness through active campaigns could help these user groups understand their effect on the river system. Community ordinances and public outreach campaigns could provide clearer guidance about best practices along the river corridor.

Utility and Canal Companies

Utility companies have multiple utility easements that cross the river and parallel the corridor. These companies hold significant linear open space that requires access to monitor for safety and for operations and maintenance. These easements could play a larger role in providing habitat and recreation. Canal companies often return tail waters to and divert flows from the Jordan River, and return water back to the river. This water can contain seeds of invasive weeds or be impacted by stormwater.

Transportation Agencies

Streets, curbs, gutters, and sidewalks cover a large part (usually about 20 percent) of most urban areas. The run-off generated by these impervious surfaces is a significant contributor to pollution in the river. Local government transportation divisions, the Utah Department of Transportation, Utah Transit Authority, and counties and cities play an important role in controlling run-off and improving the quality of that run-off. In addition, such agencies and municipalities are often participants in providing recreation opportunities such as trails, sidewalks, bike lanes, and trail connections to the river.

Other State and Federal Agencies

Many agencies are involved in the management and development of land in and near the river. This toolbox is useful to these agencies to understand the roles of their partners and the wide range of best practices that can be employed to collaborate and further enhance the river.



*Local Project Success:
Little Confluence Site, Taylorsville, Utah
Photograph by Nancy Monteith*

The Best Practices should be considered with the context of other guiding and regulatory tools, and that of local situation and landscape.

THE JORDAN RIVER COMMISSION

The Jordan River Commission was created by an Interlocal Cooperation Agreement in August 2010. The Commission was created to implement the concepts and projects outlined in the Blueprint Jordan River; to serve as a technical resource to local communities; and to provide a forum for regional coordination of planning, restoration, and responsible development along the river corridor. The Interlocal Cooperation Agreement identifies seven purposes for the Commission:

1. Encourage and promote multiple uses of the river
2. Foster communication and coordination
3. Promote resource utilization and protection
4. Maintain and develop recreation access
5. Monitor and promote responsible economic development
6. Identify and secure funding for the acquisition of critical habitat and open space
7. Engage in ongoing planning for the identified Jordan River Blueprint study area

The Blueprint Jordan River outlines an ambitious vision for the Jordan River, including open space preservation, water quality improvement, expanded recreation opportunities, and strengthening the connections between communities and the river.

This document was developed by the Jordan River Commission to provide practical information to all Jordan River stakeholders on how to apply and implement the vision of the blueprint Jordan River at the local, parcel, and project level. The Jordan River Commission is committed to serving as a resource to local governments and helping all stakeholders understand and implement these best practices.

LIMITATIONS OF THIS DOCUMENT

The toolbox is intended to present an overview of best practices and provide a summary of information on each topic. It should not be considered as a sole source of information on each of the best practices. Additional resources, standards, and expert advice should be consulted in the design or development of projects and planning efforts. Additionally, neither this document nor the Jordan River Commission has any binding authority to impose restrictions or regulations on any land or agency along the river. This document is a guide and a resource to be used as deemed appropriate by each local government, organization, landowner, or agency.

CONTEXT OF THE BEST PRACTICES



LAND USE

Photograph by Adriaan Boogard



LAND USE AS A FOUNDATION FOR RIVER PROTECTION

Land use and zoning tools play a critical role in shaping the character and physical development of local communities. Zoning codes, supported by the policies of a general plan, not only set the rules for the development of land but also for the protection of important local resources, such as wildlife habitat, scenic areas, and historic resources. Furthermore, proper land use regulations and policies can direct development away from flood-prone river areas and may reduce the loss of life and property during floods and the high cost of repairing damaged structures and infrastructure.

COORDINATION OF LAND USE TOOLS WITH TRADITIONAL BEST PRACTICES

In the context of protecting and enhancing the Jordan River corridor, this means that communities along the river should supplement traditional best practices, such as stormwater detention and filtering systems discussed above, with land use strategies that address river health on a broader, landscape level. For example, creating a river buffer zone that promotes development that reduces impervious surface and land disturbance near the river can significantly improve water quality and riparian habitat. Similarly, the river's long-term health will be enhanced by encouraging or requiring cluster subdivisions and development that permanently protect open space and wildlife habitat by concentrating new homes on smaller lots on the least sensitive portions of the site. Such strategies can significantly reduce the need for expensive stormwater best practices in the first place. They also help achieve other important goals, such as improving the aesthetic quality of the river and providing recreational opportunities. The key is to carefully coordinate the implementation of these land use tools with more site-specific traditional best practices and green infrastructure.

ADDRESSING CHALLENGES IN LAND USE REGULATION

Adopting new land use and zoning tools, however, involves challenges not typically associated with traditional best practices. Because zoning tools can impact the value and use of property, some landowners may resist or oppose such measures and they can put pressure on decision-makers who often want to avoid controversy. Given this consideration and the diverse character of the communities along the Jordan River, it is important to recognize that most zoning tools can be designed in a flexible manner to respond to local political and geographic circumstances. For example, instead of adopting a new uniform riparian setback, incentives (e.g., reduced parking or additional height) can be used to help off-set any additional financial burden or site-design constraints imposed if a landowner voluntarily provides the additional setback. Or, some communities may want to adopt performance-based standards (e.g., post-development run-off rates must not exceed pre-development rates) that allow landowners to design their own solution for compliance rather than having to meet,

for instance, a uniform impervious coverage standard. Another major zoning challenge is to address existing development that will not comply with newly adopted river corridor standards called “nonconformities,” as well as special standards for infill and redevelopment. This point is especially important for communities that already have an extensive amount of current development within one half mile of the river. A major goal for these communities should be to carefully inventory their existing development in the river zone and then develop a plan for converting these areas, especially brownfields and other blighted areas, to uses that better protect the river, including open space and recreational uses where possible.

SUPPORT AND ENHANCEMENT OF EXISTING LOCAL EFFORTS

Many communities along the Jordan River have already adopted some level of zoning measures to improve the health of the river. This best practices manual is intended to not only support these efforts but provide guidance on how each community can go even further by adding creative new zoning tools to further protect an irreplaceable natural and cultural resource.

INCENTIVES FOR PRIVATE LANDOWNERS AND DEVELOPERS

Providing incentives is a good way for local governments to encourage landowners to implement the best practices presented in this section. Typically, a zoning incentive is a financial inducement intended to offset the additional cost or inconvenience, if applicable, of integrating a best practice into a project. It is not a direct payment to the landowner but usually takes the form of allowing additional development intensity (e.g., floor area or height) or relaxing an existing development requirement to reduce development costs (e.g., parking). Other incentives may include a streamlined or fast-tracked approval process, a reduction or a waiver of fees. Incentives are optional and not mandatory, so they only get used if the landowner chooses to use them; otherwise, the regular zoning standards apply. It is important that the community analyze and weigh the additional potential impacts of incentives, such as the impacts of increased density on adjacent properties, when the incentives are being considered.

INCENTIVES FOR LOCAL GOVERNMENTS

For community officials, the incentives for implementation of the best practices include: reduction in flood mitigation/ prevention, greater opportunities for recreation, more open space, improved quality of life, increase in property values near the river and open space, and increased competitiveness for attracting new business investments to a city.



*Local Project Success:
Swaner Nature Preserve, Snyderville Basin
Photograph by Laura Hanson*

BEST PRACTICES

Enhance river buffer

Protect undisturbed areas

Encourage clustered development to protect open space

Encourage green site design and management practices

Embrace the river as an amenity



Local Project Success:

*Great Salt Lake Audubon - project implementation,
Utah Reclamation Mitigation Conservation
Commission - owner (10600 South)
Photography by: Tyler Allred*

ASSOCIATED BEST PRACTICES:

- L** Protect undisturbed areas
- E** Manage invasive and nuisance species
- E** Improve and restore native plant diversity
- R** Provide river access where appropriate
- S** Minimize impervious surfaces

WHY IS THIS BEST PRACTICE IMPORTANT?

Enhancing the river buffer is important for protecting water quality, improving flood protection, and maintaining native vegetation along the river that supports aquatic and terrestrial species diversity. It also supports recreational uses and limits development that may adversely impact the river.

DESCRIPTION

A river buffer is a protective zone placed along a river that limits development and other activities that may negatively impact the river. In particular, it is intended to protect sensitive natural resources, such as riparian vegetation, wildlife habitat, migration corridors, and water quality. Protecting willows and other larger riparian vegetation will create a ribbon of green along the river and serve as a clear visual marker of the river that will bring greater awareness of the river to the community. A buffer will also protect recreational opportunities and enhance scenic beauty. The meander corridor of the river should be incorporated into the buffer if feasible or receive similar land use protections. The width of a buffer varies depending on the goals of the community, but in most cases it ranges between 50 to 200 feet. Consideration should also be given to integrating or marking wildlife crossings on roads that bisect the buffer where animals use the buffer as a movement corridor. Buffers may also be divided into multiple zones or tiers so that the areas closest to the river have stricter standards than areas on the periphery of the buffer.

BENEFIT

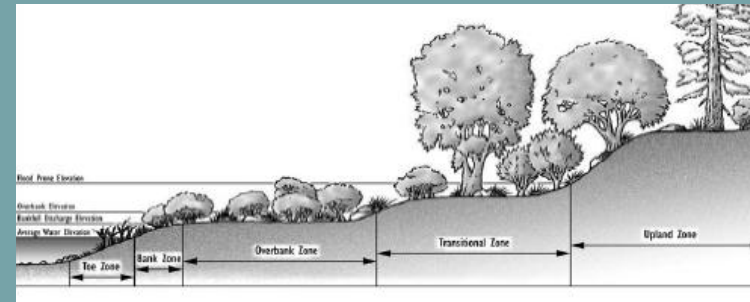
- Protects native riparian and upland plant species near the river
- Enhances water quality and fish habitat by filtering water of nutrients and pollutants and reducing sedimentation
- Increases wildlife habitat and migration routes along the river corridor
- Increases bank stability
- Improves natural river function
- Reduces loss of life and property due to flooding
- Increases connections with adjacent open spaces
- Improves aesthetics for recreational user groups and others by providing a continuous 'green' corridor along river

CONSIDERATIONS

- Existing development patterns
- Coordination with other local open-space and river-protection efforts

HOW TO

- Conduct vegetation and species inventory of existing river corridor
- Prioritize riparian resources for protection
- Inventory existing land uses and development potential within potential river buffer
- Establish a river buffer that balances river protection, development rights, and existing development patterns



Riparian Planting Zones can be used to determine where riparian species should be planted in relation to the waterline. This is a general depiction of a riparian zone. Not all streams look like this one. In the real world, some of these zones may be absent. (From Hoag 2001, Hoag and Landis 1999)

IMPLEMENTATION REQUIREMENTS AND COST

- For jurisdiction: Modest cost for staff time to develop and adopt code amendment (more if biological assessments are required to identify buffer area)
- For landowners: Possible modest cost to comply with buffer requirements for new projects

LONG-TERM MANAGEMENT

- Minor to modest staff time to enforce and periodically update buffer standards

WHY IS THIS BEST PRACTICE IMPORTANT?

Protecting significant areas of habitat and open space are two of the most fundamental ways to protect a river's water quality and natural character. Undeveloped land filters stormwater, controls flooding, and supports fisheries and terrestrial wildlife at no cost. It also serves as an amenity for recreation, enhances scenic beauty, and often increases the value of adjacent property.

DESCRIPTION

Large, open areas of land come in a variety of forms, such as natural areas with little or no impacts from development, lands reclaimed from development, and biologically improved areas (artificial wetlands). These areas are dominated by native vegetation, are "natural" in appearance, and often function as the last vestiges of urban habitat for local and migratory wildlife. Public access, such as trails, may be allowed in limited circumstances, but human activity is generally prohibited to ensure maximum protection of the land. When connected together, these undisturbed areas can form much-needed corridors of habitat for a variety of animal species. Zoning tools include mandatory or incentive-based standards for new subdivisions (e.g., cluster subdivisions), requirements to protect native vegetation, and limits on development in mapped wildlife habitats and migration corridors. In addition, protecting wetlands from development and/or requiring aggressive mitigation of filled wetlands (e.g., 2:1 ratio) can greatly enhance riparian environments near rivers. More aggressive options include Transfer of Development Rights (TDR) programs and rezoning lands along the river for lower density development. Working with land trusts to purchase conservation easements is a great non-regulatory way to protect open space as well. Regardless of the zoning tool used, the property owner must not be denied all economically beneficial use of their land.

BENEFIT

- Provides enhanced on-site stormwater filtration and reduces sedimentation to river
- Improves aesthetics and creates a more natural character along river
- Provides critical wildlife habitat
- Provides recreation opportunities, such as birdwatching and exercise
- Provides flood control

IMPLEMENTATION REQUIREMENTS AND COST

- Initial public costs are minimal because land is generally being protected from development through the development approval process and remains privately owned. If open space is purchased by the public by easement or outright sale,

HOW TO

- Identify large, natural areas for protection along river corridor
- Seek connections to other open space areas
- Work with developers to maximize open space and encourage compatible land uses
- Work with other entities, such as state agencies and land trusts, that may have funding to permanently protect open space



then the initial cost can be considerable. In addition, if public improvements are planned, such as wetlands restoration, trails, or parking facilities, then significant additional up-front costs would be expected for public open space.

LONG-TERM MANAGEMENT

- As with initial costs, ownership typically determines long-term management costs of open space. Thus, whether the area is owned by the public, a home owner's association, an individual, or is under conservation easement with a land trust, the costs will vary and be borne by different entities. Regardless, in most cases, it is important to set aside money and personnel to provide consistent oversight and maintenance (e.g., weed control) for open space.

RESOURCES

- Smith, K. A. South Jordan City Jordan River Corridor Open Space and Habitat Conservation Master Plan and Management Guidelines
- Summit County, Colorado (wildlife habitat protection overlay)
- Tucson, AZ (native plant preservation ordinance)



Local Project Success:
Legacy Nature Preserve Open Space
Photograph by Eric McCulley

ASSOCIATED BEST PRACTICES:

- L** Protect undisturbed areas
- E** Improve and restore native plant diversity
- S** Manage stormwater with alternative system designs and strategies
- S** Minimize impervious surfaces



*Local Project Success:
Springview Farms, 146000 South, Bluffdale
Photograph by Chris McCandless*

WHY IS THIS BEST PRACTICE IMPORTANT?

Clustering development preserves environmentally-sensitive land and open space by locating new development on less sensitive parts of a property. It is a strategy that communities and landowners can use to ensure private investments and development potential are protected, while at the same time allowing for protection of open space within the Jordan River Corridor.

DESCRIPTION

Clustered developments—sometimes called “conservation subdivisions”—generally are created through the subdivision process because this is the community’s primary opportunity to impact the location and design of new development, such as the location, number, and layout of new lots. Typically, clustered subdivisions do not increase overall density on a site but rather are designed to allow dwellings to be grouped together on smaller lots located away from protected sensitive areas (e.g., rivers, wildlife habitat, natural hazards, farmland). This is done by allowing a smaller minimum lot size than required by the regular standards, overall density does not need to increase. For example, on a 30-acre parcel with a three-acre minimum lot size, the regular standards would require that the ten permitted lots be spread evenly throughout the entire parcel, leaving no private or public open space. However, a cluster subdivision could cluster all ten units on five total acres (half-acre lots) or ten total acres (one-acre lots), leaving 25 or 20 acres as protected open space. Not only does this protect open space, but it consumes far less land with hardscape and infrastructure and thus can significantly reduce the cost of development for the landowner. Clustering works better where sewer service is available but can be done with septic systems as well. The open space is usually permanently protected with an easement and is often managed by a home owner’s association according to the subdivision’s approval conditions. Some communities make clustered subdivisions mandatory in designated sensitive areas, while others make clustering optional, sometimes offering a density bonus as an incentive to encourage clustering or offset any potential loss in property value. In more complex programs, TDR programs can be used to enhance the effectiveness of clustered development.

BENEFIT

- Protects open space and wildlife habitat and recreational opportunities
- Reduces footprint (e.g., grading, roads, infrastructure) of new development
- Is a flexible tool that can be designed to fit the needs of diverse communities
- Potential to increase property value, including value of surrounding property
- Reduces capital and ongoing maintenance costs for linear mileage of infrastructure, roads and sewer, etc.

HOW TO

- Identify open-space related resources that community wants to protect
- Develop clear criteria for clustering (when it’s required and how it should be done)
- Consider property rights
- Amend subdivision ordinance but provide flexibility based on community needs



*The original site plan called for a conventional subdivision of 34 house lots of 80,000 sq ft (just under 2 acres) each on the 85 acre site, which takes up all the unbuildable land (floodplain, wetland, and steep slopes).
Image credits: Randall Arendt, Growing Greener, 1999.*



The clustered site plan calls for 34 house lots of 36,000 sq ft (0.85 acres) each, on the same 85 acre site. The result is permanent preservation of 48.5 acres of open space, or nearly 2/3 of the site, while maintaining the same overall housing density.

ASSOCIATED BEST PRACTICES:

- L** Protect undisturbed areas
- E** Enhance connectivity between habitat patches
- E** Improve and restore native plant diversity
- R** Provide river access where appropriate
- S** Minimize impervious surfaces

IMPLEMENTATION REQUIREMENTS AND COST

- For jurisdiction: Minimal cost for adoption of code amendment
- For landowners: Depending on requirements of ordinance and market conditions, potential for modest loss in development value due to smaller and more concentrated lots that may not be offset by possible reduced infrastructure costs or increased property values from proximity to open space amenity.

LONG-TERM MANAGEMENT

- Minor staff time to enforce and periodically update clustering standards
- Minor to moderate staff time to monitor and enforce conservation easements for open space, if held by local jurisdiction

RESOURCES

- Riley County, Kansas; Sheridan County, Wyoming, Conservation Design Subdivision
- McMahon, T. Edward, Conservation Communities: Creating Value with Nature, Open Space and Agriculture, 2010.

ENCOURAGE GREEN SITE DESIGN AND MANAGEMENT PRACTICES

LAND USE

L

WHY IS THIS BEST PRACTICE IMPORTANT?

Green site designs use more natural-based techniques to reduce impervious surface, encourage green infrastructure (e.g., rain gardens, bio swales, landscaping), and generally locate development to protect the natural resources and functions of a property. The result is improved water quality, stormwater management, flood protection, and a more natural character.

DESCRIPTION

Green site design, also called Low Impact Development (LID), encompasses a wide variety of zoning tools but tends to focus on techniques that manage stormwater and protect natural features. It tends to avoid expensive, traditional engineering strategies, such as continuous curb and gutters and piping to convey stormwater (“grey infrastructure”), and relies more on natural filtration systems. Green site design features can apply to lots of all sizes. Examples include vegetated roofs, integrated landscaping and stormwater plans, reduced parking requirements, narrower streets, wetland buffers, and allowing green infrastructure to count as open space. It may also include requiring the use of native landscaping, the protection of existing trees, minimizing of land disturbance, and encouraging pedestrian and bicycle connections. Communities should also work with land owners to retrofit existing facilities and uses, such as golf courses and parking lots, to incorporate the latest green design techniques. Successful implementation of green site design often requires increased flexibility from existing development standards, such as outdated engineering standards and building setbacks, to accommodate innovative site design solutions.

BENEFIT

- Provides enhanced on-site stormwater filtration and reduces sedimentation to river
- Often reduces long-term maintenance costs compared to traditional approaches
- Uses land more efficiently and protects open space
- Improves natural river function
- Improves aesthetics and creates a more natural character

IMPLEMENTATION REQUIREMENTS AND COST

- Varies according to green design technique. Some techniques will save money in implementation (e.g., reduced parking) while others would have modest to significant increased cost (e.g., vegetated roof).

HOW TO

- Identify natural features on site and prioritize protection
- Incorporate natural features into green design techniques
- Modify project design to maximize use of green site design
- Choose the most simple and maintenance-free green design features when possible



This site incorporates a natural stormwater detention basin into the landscaping.



A rain garden works by capturing stormwater to irrigate plants, while at the same time reducing runoff and filtering the water.



*Local Project Success:
Associated General Contractors Building
West Valley City
Stormwater detention landscape*

LONG-TERM MANAGEMENT

- Varies according to green design technique and standards but the key is ensure that adequate money and personnel are identified to maintain green site designs to ensure proper function and visual appearance.

RESOURCES

- Portland, Oregon (green roofs, rain gardens, pervious pavement, stream protection)
- Emeryville, California (green infrastructure design guidelines)
- Lancaster, Pennsylvania (Green Infrastructure Plan)
- Green Infrastructure: A Landscape Approach, American Planning Assn. PAS Report 571
- Calkins, Meg. 2012. The Sustainable Sites Handbook: A Complete Guide to the Principles, Strategies, and Best Practices for Sustainable Landscapes. John Wiley & Sons, Inc. Hoboken, N.J. April 2012.

ASSOCIATED BEST PRACTICES:

- L** Protect undisturbed areas
- E** Improve and restore native plant diversity
- S** Manage stormwater with alternative system designs and strategies
- S** Minimize impervious surface



*Local Project Success:
Swaner Nature Preserve, Snyderville Basin
Photograph by Laura Hanson*

WHY IS THIS BEST PRACTICE IMPORTANT?

One of the best ways to protect the Jordan River is to integrate it into the fabric and lifestyle of the community. The more a community interacts positively with a river the more motivated and vocal its residents will become in defending the river from threats. Preservation and enhancement should be the first goal and river-compatible site design the second goal. The river thus must not only be protected from physical degradation from development but also against development that is incompatible in character with the river's natural environment and context. While compatibility is a subjective goal, many communities have successfully defined what compatibility means as a policy and regulatory tool.

DESCRIPTION

Buildings that are out of scale with the river or land uses that are inconsistent with the desired character of the river should be avoided. Better yet, new structures and land uses should embrace the river corridor and incorporate the river environment as an amenity into the site's design rather than ignoring the river or blocking access to it as is too often the case. It also needs to respect the natural constraints of the river, such as the likelihood of flooding and associated wetlands and high ground water. Traditionally, development along rivers, especially industrial and non-residential development, is often oriented away from the river or only uses the river as a means of waste disposal, often hiding the river from public view and access. In particular, communities should plan for the conversion of existing development, such as aging industrial sites, to less intensive and more river-friendly development. Identifying such opportunities in advance with a plan is a good way to ensure the community is ready when a site becomes available for redevelopment. The goal is to create development that is compatible with the river corridor from a land use, site design, and visual perspective.

Land Use Compatibility:

Land use should be tailored to take advantage of the unique river setting and respect its sensitive environment. Uses such as outdoor recreational shops, environmental nonprofits, community gathering and visitor facilities, trails and trailheads, and retail uses that truly feature the river as part of its business should be encouraged. Other less intensive uses, such as agriculture, public parks, golf courses (with strong fertilizer and run-off requirements), and ball fields are also appropriate, especially where flooding from the river is possible. Industrial uses and uses with high impervious surface requirements (e.g., shopping malls) and lighting impacts (e.g., car dealerships) should be discouraged.

Site Design Compatibility:

New development and redeveloped areas should incorporate the river into their site designs by, for example, creating river walks that bring pedestrians closer to the river, outdoor eating areas that overlook the river, or plazas and other public spaces that feature or provide access to the river. Green infrastructure should be used whenever possible to retain and enhance the natural functions of the site.

Visual Compatibility:

Regardless of use, structures near the river should use colors (e.g., earth tones) and architectural styles that blend visually with the river environment. Buildings should also be oriented toward the river, even if the main vehicular access is on the non-river side of the building (i.e., full architectural treatment, large windows, and outdoor spaces should be provided on facades facing the river). The scale of buildings should be limited to avoid creating a "canyon" effect along the river and be spaced apart or broken into sections to provide visual breaks to and from the river. Landowners along the river should also restore the native river habitat when possible to not only improve the environment but their property values and development potential as well.

EMBRACE THE RIVER AS AN AMENITY (cont.)

LAND USE

L

BENEFIT

- Improves aesthetics and creates a more natural character along the river
- Increases awareness of the river in community and creates a committed constituency for the river
- Creates a “brand” for the river that can be used to improve local business opportunities
- Reduces risk to life and damage of property from flooding

CONSIDERATIONS

- Existing development patterns
- Redevelopment of incompatible uses

IMPLEMENTATION REQUIREMENTS AND COST

- Implementation requirements and costs are minimal because land is generally being protected from development and left in its natural condition so maintenance costs are negligible.
- If enhancement activities are planned, such as wetlands restoration, additional up-front costs would be expected.

LONG-TERM MANAGEMENT

- Long-term governmental administration costs would be minimal.

RESOURCES

- San Antonio, Texas, River Improvement Overlay District (more urban context)
- Dallas, Texas/North Texas: Trinity River initiative

HOW TO

- Incorporate the river corridor into site planning as a major feature in the landscape
- Orient development towards the river corridor, and/or provide attractive facades and entrances on any building sides facing the river corridor
- Identify desired character for river corridor
- Develop architectural and site design standards to enhance desired character
- Encourage compatible land uses



This subdivision incorporates a pedestrian pathway connecting the homes to a common open space.



This park space provides easy public access to a river for boating, fishing, and birdwatching.



*Local Project Success:
Springview Farms, 146000 South, Bluffdale
Photograph by Chris McCandless*

ASSOCIATED BEST PRACTICES:

- R** Integrate active recreation that maintains river function and wildlife
- R** Provide river access where appropriate
- S** Manage stormwater with alternative system designs and strategies
- S** Minimize impervious surfaces

ENVIRONMENT

Bullock's Oriole
Photograph by Richard Young



PRESERVATION AND ENHANCEMENT OF THE RIVER CORRIDOR

The Jordan River represents a rare and important lowland riparian environment for many native fish, birds, mammals, reptiles, amphibians, and macroinvertebrates. The river corridor and the Great Salt Lake are also important stop-off areas for migratory birds using the Central Flyway and Pacific Flyway migratory paths across the U.S., creating critical resting and foraging habitat for migratory and resident bird species. Vegetation along the corridor includes wetland, riparian, and upland communities, which have undergone considerable alteration as a result of encroaching human development. Native biodiversity, habitat quality, and connectivity have been considerably reduced. Furthermore, exotic and invasive flora and fauna have proliferated in the wake of human disturbance to the Jordan River corridor resulting in a more homogeneous, less diverse community. As a result of these alterations, the functions and values of the corridor, including habitat values, and filtering and attenuation of stormwater, have been compromised.

FUNCTIONAL DIVERSITY

Human activities can affect the health of ecosystems and their natural functional abilities. Specifically, negative impacts can occur through land use change, habitat modification and destruction, increased air and water pollution, erosion, and misuse of pesticides. Such activities can be naturally counteracted by increasing the variety of species (or diversity), and the number of species (or richness) in an ecological community. At a local scale, increasing species diversity and richness improve ecosystem services by providing increased habitat potential; pollination services of native and agricultural plants; nutrient cycling; and food, water, and fuel opportunities. At a larger scale, a healthy ecosystem can help regulate climate, nitrogen deposition effects, erosion, and flooding; maintain biodiversity; and purify air and water. Fortunately, ecosystem functioning (e.g., nitrogen retention) begins to improve at modest species richness (20 to 30 percent of possible species richness of an area). Excess nitrogen and phosphate (from fertilizer, leaking sewers, animal waste, and atmospheric deposition) is a pollutant that can enter waterways and cause eutrophication of water courses with negative impacts on aquatic species and affect drinking water quality and human health. Therefore, restoring species diversity and richness along the Jordan River corridor ultimately would improve the health of the river system and provide long-term benefits for urban residents.

RESTORATION

To achieve long-term sustainability, planning to restore the functions and values of the corridor must consider objectives at both the species and community scale, with species adapted to the area: native species. Increasing diversity requires coordination of conservation activities. Improving the corridor will require restoration of three ecological communities (i.e., aquatic, riparian, and upland), thereby increasing habitat heterogeneity and encouraging native species in the corridor while simultaneously reducing the spread of invasive species. Reduction and replacement of invasive species should be undertaken gradually if native species have adapted to using them as a resource. Going beyond a “green” corridor by using structural and successional complexity of native vegetation improves species diversity and long-term sustainability of the Jordan River corridor as a functioning and healthy ecosystem. Restoration projects along the Jordan River corridor would benefit from using a two-pronged restoration approach to improve the structural diversity of habitat (understory, mid-story, and canopy), and increase the size and connectivity of fragmented habitat patches.

TWO-PRONGED RESTORATION APPROACH:

1. Increase habitat patch areas and complexity (horizontal and vertical structure)
2. Increase habitat connectivity (lateral and length) between patches

Increase habitat patch areas and complexity (horizontal and vertical structure)

The goal of this approach is to create large areas of linked quality habitat to protect biodiversity. Larger habitat patches have the potential to support a greater variety and number of species. However, smaller areas (patches) are often the focus of restoration projects in fragmented landscapes and are suitable for species with smaller habitat requirements. Habitat patch size and connectivity varies along the length of the Jordan River corridor; therefore, it is important not to view available habitat in isolation but rather as a mosaic of fragmented patches that have the potential to be linked.



*Local Project Success:
Utah Transit Authority, Mid-Jordan Light Rail Project
wetland mitigation site, Murray, Utah
Photograph by Nancy Monteith*

BEST PRACTICES

Improve natural river function

Improve bank stability

Manage invasive and nuisance species

Enhance connectivity between habitat patches

Improve and restore native plant diversity

Within any habitat patch, the restoration goal should be to have a range of age classes of dominant tree and or shrub species and increase the number and type of native species present (trees, shrubs, forbs, sedges, bunch grasses). Guidelines for selecting appropriate native plants adapted to the inter-mountain west riparian/upland areas are available for local restoration projects (Johnson and Buffler 2008). Patch shape is also an important consideration. Long thin patches have a lot of “edge” compared to usable habitat. The increase in edge can negatively affect predation rates and may alter the microclimate within habitat patches, creating potentially drier, hotter, more arid environments that favor species that readily adapt to human disturbance (weed potential and generalists). A reduction in patch “edge” can be achieved through adaptive mowing techniques tuned to natural growing seasons and sensitive to patch shapes and dynamics. The advantage of more natural management methods can be a reduction in vegetation maintenance costs.

Increase habitat connectivity (lateral and length) between patches

Connectivity between habitat patches is important for most species of wildlife, particularly large wide-ranging species that are isolated due to increasing human development and land use change. Connecting habitat patches with habitat “corridors” increases genetic diversity and long-term sustainability of wildlife species by allowing individuals to move between subpopulations. The amount of habitat required for an effective movement corridor is highly dependent on each species. Oftentimes, more than one species may benefit from a corridor designed for an indicator species. Thus, restoration projects benefit from expertise in species habitat requirements and movement capabilities. Quality of patch measured by size, structural complexity, and succession potential could be linked to widths of 50 to 100 feet, 100 to 200 feet, and 200 to 300 feet and would be expected to attract various bird species.

Given the difficulty of determining the effective width of a functional movement corridor (i.e., dependent on species, representative scale, movement potential, and behavior), another approach is to consider the natural corridor in terms of a “riparian buffer” that protects the Jordan River from adjacent development and pollution, while also providing bank stabilization and wildlife habitat. Recommendations exist on effective buffer widths to counteract non-point source pollution and maintain and improve water quality.

Buffers provide the following:

- Important hydrological and ecological “rights-of-way”
- Water quality protection
- Streambank stabilization
- Floodplain alteration
- Groundwater recharge
- Habitat protection and food chain support
- Sociological and economic benefits to communities

Wetland buffers offer recreation, aesthetic, economic, and educational opportunities for neighborhoods and schools, promoting healthy lifestyles and enhanced community stewardship and relationships.

IMPROVE NATURAL RIVER FUNCTION

ENVIRONMENT

E

WHY IS THIS BEST PRACTICE IMPORTANT?

Improving natural river function offers greater long-term benefits than localized bank stabilization projects including mitigation of flood events, reduced maintenance, and improved quality of the natural environment.

DESCRIPTION

Rivers are complex, dynamic physical and biological systems. They are a result of, and a response to, seasonal fluctuations of temperature, precipitation, and human use. Although water levels in the Jordan River are regulated by the Utah Lake compromise level, extreme fluctuations in water volume are still possible.

Areas of the Jordan River where the flood plain and meander corridor have been least impacted by development respond to changes in water level with little damage to natural systems or property. Areas that have been channelized or deeply incised have a greater risk for bank failure, erosion, and flooding; often require costly patch repairs; and are at risk for future failure. Preservation of natural processes, including natural meander corridors and flood plains, offers the lowest cost protection against flooding and other damages that result from river fluctuations. Mitigation and restoration of incised rivers to correct flood, stormwater, and water quality problems are effective but can be more expensive to implement than preserving natural river processes.

BENEFIT

- Natural flood and erosion control, which includes reducing flood velocities and flood peaks and curbs sedimentation
- Improved water quality by filtering nutrients, processing organic wastes, moderating temperature fluctuations, and recharging of groundwater
- Improved habitat for native fish and wildlife and protection of sensitive species
- Improved quality of the river, enhanced recreational opportunities, and potential for wildlife viewing

IMPLEMENTATION REQUIREMENTS AND COST

- Protection of existing intact natural areas and hydrologic regime: minimal
- Flood control structures and bank stabilization: very high
- Maintenance of existing incised river channel: very high

HOW TO

There are a range of approaches, depending on existing conditions and desired future conditions. It is important to:

- Protect and restore the river's pattern, profile, and dimension
- Discourage development within the floodplain to allow for natural meandering of the river through its corridor.
- Use natural channel design methods to restore the stream to a more stable form, which will allow the stream to create in-stream aquatic habitat such as pools and riffles
- Allow connectivity of the river with its floodplain
- Restore vertical river banks to a more gentle relief using laying back dredge berms or levees where possible to reduce erosion and allowing natural movement and deposition of stream sediment.



Highly degraded stream with severe bank erosion (left). The same stream segment after restoration (right). Images taken of Mitchell River, NC., Image credit: San Antonio River Authority, <http://www.sara-tx.org>



Local Project Success:
Legacy Nature Preserve Open Space
Photograph by Eric McCulley

ASSOCIATED BEST PRACTICES:

- L** Protect undisturbed areas
- L** Enhance river buffer
- E** Improve bank stability
- E** Manage invasive and nuisance species
- E** Enhance connectivity between habitat patches
- S** Minimize impervious surfaces

LONG-TERM MANAGEMENT

- Preservation and enhancement of natural vegetation and hydrologic regime
- Spot herbicide or mowing during community establishment

RESOURCES

- CH2M Hill. 1992. Jordan River Stability Study. Prepared for Salt Lake County.
- Proposed Big Bend Habitat Restoration project. West Jordan.

IMPROVE BANK STABILITY



Local Project Success:

*Walden Park (5400-5600 South) Murray City, Utah
Photograph by Nancy Monteith*

WHY IS THIS BEST PRACTICE IMPORTANT?

Natural vegetation in conjunction with biotechnical slope stabilization enhances bank stabilization, riparian functions, wildlife habitat potential, and aesthetics.

DESCRIPTION

This management technique improves bank stability, habitat quality and effectiveness, and riparian functions such as increased filtration and flood plain storage, and organic matter input. Improving bank stability draws upon a wide array of techniques, from planting natural vegetation and bioengineering to hard treatments such as rock placement. The selection of appropriate materials is guided by site-specific criteria such as slope steepness, as well as the stability problem being addressed. Natural vegetation and live materials, in combination with biotechnical slope stabilization techniques, provide structure to slopes and bank zones where planting alone can fail. Bank stability, wildlife habitat, and aesthetics improve over time as vegetation becomes established. Effective bank stability spans the toe, bank, and slope zones adjacent to the river and incorporates toe protection and grade control. Improving bank stability with natural materials can maintain or expand the active channel width, which reduces downstream erosion energy and avoids the problems to riparian function associated with traditional hardscape surfaces such as concrete and rip-rap.

BENEFITS

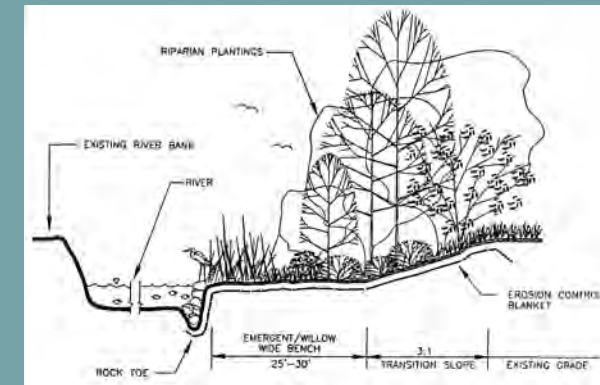
- Flexible system tailored to site-specific characteristics
- Reduced downstream velocity and erosion
- Existing habitat protected and new habitat provided
- Re-established healthy riparian zone functions
- Reduced long-term maintenance costs and erosion problems associated with impervious structures
- Aesthetically appealing with a natural appearance

IMPLEMENTATION REQUIREMENTS AND COSTS

- Project costs will vary depending on the Project requirements and the bank stability techniques used.
- Site-specific design, engineering, and materials
- Federal, state, county, and city permits
- Initial planting costs, plant mortality monitoring and replacement
- Noxious weed monitoring and control

HOW TO

- Conduct reach-scale survey of river channel banks to determine bank conditions (slope, location, and stability) and appropriate biotechnical methods and placement.
- Acquire permits from Salt Lake County Flood Control, UT Division of Water Rights Stream Alteration, US Division of Forestry, Fire and State Lands for biotechnical slope stabilization projects within riparian corridors
- Relate density of planting according to slope steepness
- Conduct site-specific professional design
- Plan construction during low flow seasons (after peak runoff) or as conditions allow
- Use appropriate materials for toe protection, bank and slope zone



A cross-section diagram of an emergent bench approach to bank stabilization. This approach creates a gentler bank slope, allowing for both stream toe protection as well as habitat using rock and native riparian vegetation to prevent erosion.

Figure courtesy of Salt Lake County Watershed Planning and Restoration Program.

LONG-TERM MANAGEMENT

- Site-specific adaptive management strategy
- Monitoring native vegetation establishment and replanting
- Irrigation of re-planted vegetation until plant establishment
- Noxious weed management over the long-term

RESOURCES

- USDA - Monitoring the Vegetation Resources in Riparian Areas
- The Practical Streambank Bioengineering Guide in Intermountain West

ASSOCIATED BEST PRACTICES:

- L** Enhance river buffer
- L** Protect undisturbed areas
- E** Improve natural river function
- E** Manage invasive and nuisance species
- E** Enhance connectivity between habitat patches
- E** Improve and restore native plant diversity
- R** Provide river access where appropriate

WHY IS THIS BEST PRACTICE IMPORTANT?

Invasive and introduced non-native plants and animal species can out-compete, reduce, or eliminate native species and negatively affect habitat quality and suitability, species diversity, and ecosystem function.

DESCRIPTION

Invasive and nuisance species are plant and animal species inadvertently or deliberately introduced, or successfully spread, to an environment outside their native range and may cause economic or environmental harm or harm to human, animal, or plant health. Invasive and nuisance species often thrive in the wake of human settlement and urban or agricultural disturbance. The success of invasive species is often due to a competitive advantage over native species, such as the ability to spread and reproduce rapidly in the absence of predation and other limiting environmental factors present in their native habitats and superior tolerance of environmental and climatic fluctuations. Within the Jordan River corridor, there are many introduced trees and shrubs, invasive weed species, and non-native or nuisance fish, bird, and mammal species including the American beaver (*Castor canadensis*) (National Audubon Society 2000). The most important management approach to invasive plant and animal species is prevention, as total eradication can be difficult. Once established, best practices should aim to reduce and control the spread of invasive and non-native or nuisance species using species-specific approaches that work with natural cycles to maximize removal and minimize environmental impacts. Managing invasive species is the first step in successful habitat restoration projects along the Jordan River corridor.

BENEFIT

- Improved probability of success of habitat restoration projects
- Improved habitat quality for increasing native species diversity
- Improved water filtration, erosion control, and nutrient cycling
- Improved aesthetics for recreational user groups by restoring native wildlife to corridor

IMPLEMENTATION REQUIREMENTS AND COST

- Prevention most cost-effective approach
- Management costs reduced through early detection and rapid response
- Cost of long-term management effort

LONG-TERM MANAGEMENT

- Site and species specific adaptive treatment strategy
- Monitoring program to detect locations at which weeds become established
- Public education, outreach, and training on prevention and control

HOW TO

Three step approach:

Prevention

- Develop comprehensive management approach in consultation with scientific and technical experts and societies, stakeholders, and affected industries
- Prioritize invasive species control and effective mitigation tools
- Identify pathways of invasive species introduction and their potential impact

Early detection and rapid response

- Develop program to improve detection and identification of invasive species
- Coordinate response efforts to eradicate species before establishment and spread

Control and management

- Limit spread and reduce effects by targeted eradication or population suppression
- Implement Integrated Pest Management (IPM) to reduce cumulative environmental impacts of management methods
- Establish institutional controls that follow local ordinances to control invasive plant populations on private lands (to compliment state statues) that may spread to the Jordan River corridor
- Cooperatively manage or address nuisance species in the event that species cause economic or environmental harm, or harm to human, animal, or plant health

RESOURCES

- Noxious Weed Act (November 1, 2012); State of Utah guidelines on the control and prevention of noxious weeds
- National Invasive Species Management Plan (2008-2012)
- Salt Lake County Natural Areas Land Management Plan Standards and Operational Manual, December. 2007



*Local Project Success:
Little Confluence Site, Taylorsville, Utah
Photograph by Nancy Monteith*

ASSOCIATED BEST PRACTICES:

- L** Enhance river buffer
- L** Encourage green site design and management practices
- L** Protect undisturbed areas
- E** Improve natural river function
- E** Enhance connectivity between habitat patches
- E** Improve and restore native plant diversity



Local Project Success:

Great Salt Lake Audubon - project implementation,
Utah Reclamation Mitigation Conservation
Commission - owner (10600 South)
Photography by: Tyler Allred

ASSOCIATED BEST PRACTICES:

- L** Protect undisturbed areas
- E** Improve bank stability
- E** Manage invasive and nuisance species
- E** Improve and restore native plant diversity
- R** Provide river access where appropriate

WHY IS THIS BEST PRACTICE IMPORTANT?

Important for maintaining species diversity and sustainability along the Jordan River corridor as well as mitigating long-term habitat degradation and loss due to increased urbanization and alterations in land use.

DESCRIPTION

Historical alteration, human settlement, and development have resulted in extensive fragmentation of terrestrial, aquatic, and plant habitat along the Jordan River. The result is disconnected patches of habitat that vary in size, shape, and quality and, therefore, in value to native wildlife. The value of habitat is generally measured by its ability to provide adequate foraging, breeding, and cover opportunities for long-term survival. Long-term survival of many migratory and resident species depends on connected contiguous habitat patches. Connectivity allows movement between habitat areas and safeguards species from natural and man-made environmental disturbance. Best practices that enhance connectivity create links between otherwise isolated patches of wildlife habitat and circumvent existing man-made barriers. Areas of connectivity are given the same considerations as habitat quality established for native habitat patches. Enhancing connectivity requires weed removal and control, planting of native plant seed mixes or plugs designed to introduce structural complexity, or the installation of structures designed to facilitate movement of wildlife species along the Jordan River corridor.

BENEFIT

- Protection of native species from natural and man-made environmental disturbance
- Potential of increasing the extent of quality wildlife habitat along the river corridor
- Potential to connect habitat in river corridor to adjacent open spaces
- Improved water filtration, erosion, and nitrogen deposition control
- Improved aesthetics for recreational user groups

IMPLEMENTATION REQUIREMENTS AND COST

- Invasive plant removal
- Biological survey of existing habitat areas and targeted species
- Initial planting or installation costs and plant replacement
- Noxious weed monitoring and control

HOW TO

- Conduct site inventory of existing habitat condition and fragmentation, and man-made or natural barriers
- Identify indicator species that maximize movement opportunities for a biological community
- Prepare site - remove invasive plant and hardscape materials
- Install native vegetation mix that addresses short- and long-term functionality habitat goals
- Install alternative movement structures e.g., box culverts under river bridges
- Perform regular and adaptive watering during initial growing season (2-to-3-day cycle) and as needed
- Manage and control noxious weeds during initial growing season and over the long-term



As habitat patch size increases, so does its value to the wildlife that depends upon it. Site revegetation and planning, can transform an area with small patches of native vegetation with little habitat value to a system of connected resources with significant cumulative habitat value.

Image: <http://www.smartgrowthvermont.org/toolbox/issues/wildlifecorridorprotection/>

LONG-TERM MANAGEMENT

- Habitat maintenance
- Monitoring program of corridor connectivity effectiveness
- Monitoring and management of invasive or nuisance plant and animal species
- Irrigation until plant establishment

RESOURCES

- Beier and Lowe. 1992. A checklist for Corridors.
- National Audubon Society. 2000. The Jordan River Natural Conservation Report.

IMPROVE AND RESTORE NATIVE PLANT DIVERSITY

ENVIRONMENT

E

WHY IS THIS BEST PRACTICE IMPORTANT?

Restoration improves wildlife habitat features and functions as well as environmental quality and value for recreational user groups.

DESCRIPTION

Restoration of native plant diversity and wildlife habitat describes best practices designed to improve three habitat communities: aquatic, riparian, and upland that naturally occur along the length of the Jordan River. Restoration of the three habitat communities can increase native wildlife habitat area and species diversity. Increasing species diversity can enhance ecological functioning, reduce the spread of invasive species, and minimize long-term vegetation management costs. Aquatic, riparian, and upland communities describe unique plant and wildlife assemblages associated within and adjacent to the river and contiguous manicured open space zones. Restoration requires an initial evaluation of the level of tree removal or trimming necessary to minimize flood hazards, weed removal and long-term weed management, as well as naturalized planting of native tree and plant mixes designed to introduce the structural complexity of each specific habitat community.

BENEFIT

- Long-term sustainability of native wildlife habitat
- Improved ecological function: water filtration, erosion control, and nutrient cycling
- Improved aesthetics along the river corridor for recreational user groups
- Reduced long-term maintenance costs (vegetation clearing and mowing)
- Increased wildlife viewing and bird watching potential
- Recreational opportunities (e.g., nature walks)

IMPLEMENTATION REQUIREMENTS AND COST

- Site inventory, design, and analysis
- Invasive plant removal
- Initial planting costs
- Plant mortality monitoring and replacement
- Noxious weed monitoring and control

LONG-TERM MANAGEMENT

- Site-specific adaptive management strategy
- Monitoring of vegetation establishment success and failure by season
- Vegetation replanting if habitat area is damaged or fails
- Spot herbicide or mowing during community establishment and long-term

HOW TO

- Conduct site inventory, design, and analysis
- Determine any underlying causes of disturbance and address as necessary
- Prepare site: remove invasive plant species and hardscape materials and prepare topsoil
- Protect established native trees from potential nuisance species damage by wrapping trunks with wire or 'sand' painting
- Plant native trees and seed mixes or plugs (e.g., 60 percent grass and 40 percent forb mix) depending on:
 - Short term aesthetics (fast growing native species which dominate first growing season)
 - Long-term community establishment goals (over 3 – 5 year time frame)
- Mulch (bark, straw, wood fiber) to protect newly planted areas
- Perform regular watering during initial growing season (2 – 3 day cycle) and site-specific management
- Control noxious weeds during initial growing season



Sand paint and no-step horse wire wrapping are both effective strategies for protecting both new and established native trees from beaver damage. Both strategies require maintenance over time to retain their effectiveness.

- Irrigation until plant establishment

RESOURCES

- Salt Lake County Natural Areas Land Management Plan Standards Manual, December 2007.
- Jordan River Migratory Bird Reserve Operations and Management Plan, June 2013



Local Project Success:
Great Salt Lake Audubon - project implementation,
Utah Reclamation Mitigation Conservation
Commission (10600 South)- owner
Photograph by Keith Johnson

ASSOCIATED BEST PRACTICES:

- L** Protect undisturbed areas
- E** Improve bank stability
- E** Manage invasive and nuisance species
- E** Enhance connectivity between habitat patches
- R** Provide river access where appropriate

RECREATION

*Local Project Success:
Little Confluence Open Space and
Jordan River Water Trail
Taylorsville, Utah
Photograph by Adriaan Boogard*



RECREATION AND RIVER ACCESS FOSTER STEWARDSHIP

The Jordan River Corridor provides the opportunity for people to experience a river environment and to recreate in the midst of a heavily urbanized area. The Blueprint Jordan River demonstrated wide public support in maintaining the corridor as both a natural landscape or “green corridor,” and a recreational space. Recreation and public access are instrumental to sustaining public support for the protection and enhancement of the river and its environs. Balancing recreation with protection of the environmental resources of the corridor by locating it in areas that already have human impacts, as well as protecting sensitive areas will ensure continued stewardship.

INTEGRATE RECREATION TO PROTECT THE RIVER SYSTEM

Best practices for recreation include the design of recreation features in a river-friendly manner, and the protection of sensitive habitat areas. Salt Lake County residents have shown continued support of the development of the Jordan River Trail by passing several bonds for its construction. Once complete, the 53 miles of connected multi-use trail will connect Utah Lake to the Great Salt Lake. The parkway trail also connects schools, parks, playgrounds, active recreation areas (such as golf courses and a fishing pond), and other recreation destinations located in and near the river corridor. In addition to these connections, the trail will enhance east-west connections from the communities along the river, and regional transportation stops to the river corridor. This will increase accessibility and contribute to a robust regional alternative transportation network.

Recreation areas located near the river can be designed to incorporate stormwater retention and detention basins. These features can facilitate management of water from storm events that influence river flow, and possibly mitigate potential flooding. Using park space to infiltrate stormwater before it enters the river will reduce the amount of pollutants that enter the aquatic system. Integrating bio-swales and native plants in parks and golf courses can increase and reconnect fractured habitat along the corridor. Replacing horticultural plantings that require extensive management with native species can reduce maintenance costs of park spaces, as well as contribute to the function of the natural systems and habitat.

Developing a water centric trail will allow the public to view sensitive habitats with few impacts. An important component to developing a water centric trail is the identification of safe access points to and from the river that have minimal environmental impacts, as well as the removal of navigational hazards.

PROVIDE EDUCATION AND INTERPRETATION

Enhancing education and interpretive opportunities will increase understanding of the importance of the Jordan River corridor to our region. As people use the corridor and gain a greater understanding of the river environment, they are more likely to protect it. Implementing a unified system of interpretive, regulatory, and way-finding signage throughout the corridor is an important step in cultivating appropriate use and community stewardship of the river.

BALANCE RECREATION AND DEVELOPMENT

The protection of open space for recreation, along with the protection of sensitive habitats, will become more important as development pressures increase. Communities should strive to balance the value of open space versus economic development opportunities. A well connected and usable open space system that provides recreation and ecosystem services (e.g., flood control, clean water, clean air, and relief from the urban environment) has tremendous tangible and intangible value. Recreation features can be bolstered by land use best practices, including the protection of open space over the long-term facilitated by conservation easements, Transfer of Development Rights (TDR), and overlay districts.



*Local Project Success:
Jordan River water trail
Photograph by Eric McCulley*

BEST PRACTICES

Provide river access where appropriate

Locate trails that protect river and habitat

Integrate active recreation that maintains river function and wildlife

Provide east-west trail connections from developed areas to Jordan River Trail



*Local Project Success:
Ogden River Access Ramp
Photo by Ben Nadolski*

ASSOCIATED BEST PRACTICES:

- L** Protect undisturbed areas
- E** Improve natural river function
- E** Manage invasive and nuisance species
- E** Enhance connectivity between habitat patches
- R** Locate trails to protect river and habitat
- S** Minimize impervious surfaces

WHY IS THIS BEST PRACTICE IMPORTANT?

Safe public access to river environments for biking, walking, or boating can foster public stewardship for recreational areas. Sensitive designed access can also contribute to long-term protection of the Jordan River corridor.

DESCRIPTION

Planning and design of facilities that provide access to the river (e.g., bridges, boardwalks, launches, and elevated walkways) must be planned and designed to be safe for users, protect the natural resources of the corridor, and address the fluctuations of the river.

Bridges are common along the Jordan River Trail and are vital for providing access to the corridor from adjacent communities. The location and design of bridges can enhance or restrict recreation use and experiences, as well as the corridor's safety and sustainability. Bridges along the Jordan River Trail should facilitate easy public access to recreational areas without restricting access to the water trail or impacting riparian habitat. Bridges that are too low over the river may cut off water trail access, or present safety concerns for water trail users. Bridge abutments too close to the river may be damaged by changes in water levels and bank erosion, which can lead to damage of the bridge structure and present public safety hazards. Cities and counties should look for opportunities to share bridge access to minimize the number of new bridges.

Access to and from the water trail can be provided by a variety of boat put-ins and take-outs, including natural shorelines, beaches, simple ramps, floating launches, pipe launches, cantilever launches, and concrete ramps. Development of river access facilities should consider the river's fluctuations over time. Floating ramps, stairs, and fishing piers, rather than fixed structures, can respond to changing river levels.

BENEFIT

- Sustainable recreation facilities
- Enhanced aesthetic experience of the river and varied experiences
- Protection of wildlife habitat, natural areas, and safety

IMPLEMENTATION REQUIREMENTS AND COST

- Vegetation and wildlife habitat mapping
- Vegetation management
- Facility planning and design

LONG-TERM MANAGEMENT

- On-going maintenance of recreation facilities, including snow removal, and vegetation management

HOW TO

- Locate bridges frequently enough to provide access to the corridor from adjacent communities, but not so frequently as to affect riparian habitat and use by water trail users (refer to the Jordan River Trail Master Plan for guidance on bridge locations)
- Work with adjacent communities and counties to identify the most appropriate bridge locations
- Carefully consider bridge design to maintain enough clearance for water trail users and ensure maximum space for natural river movement; bridges are also a constriction point and may cause flood control issues, as well as prevent the river from being able to meander naturally
- Use boardwalks and elevated walkways where access is required in sensitive environments
- Locate bridges and put-ins/take-outs in areas that already have human impacts and are easily visible from both the river and shore for water trail users
- Locate boat launch/take-out facilities in river eddies of sufficient size to accommodate several boats to protect the boaters, ramps, and docks from the power of the river current and to reduce erosion
- Develop access points and boat put-ins/take-outs in areas near areas for parking
- Install ramps (proven to be the best solution to take-outs and put-ins for the Jordan River)
- Use bioengineering methods to protect vegetation and stabilize shorelines for sheltering put-ins/take-outs
- Decommission bridges and put-ins/take-outs located in low value areas or that are poorly designed
- Install trash receptacles for both regular and recyclable trash at every pedestrian bridge, boat dock, and other places where people approach the river

RESOURCES

- Minnesota Department of Natural Resources. 2006. Trail Planning, Design, and Development Guidelines.
- National Park Service: Rivers, Trails, and Conservation Assistance Program. Logical Lasting Launches: Design Guidance for Canoe and Kayak Launches. 2004

WHY IS THIS BEST PRACTICE IMPORTANT?

The location of the trails in the Jordan River corridor has important environmental impacts and implications for sustainability. Locating trails that protect natural habitat areas creates a higher quality nature experience for the trail user.

DESCRIPTION

The Jordan River Trail is a popular and publicly supported regional destination trail that provides valuable recreation opportunities in proximity to communities adjacent to the river. This multi-use trail accommodates pedestrians, bicyclists, equestrians, in-line skaters, and wheelchair users.

New trail development, both along the Jordan River and its tributaries, should be safe and convenient and provide a high value experience while also contributing to a regional transportation network. Trails should be located in areas that have already been influenced by human activity, and in a manner that will minimize impacts on sensitive ecological areas while protecting large habitat patches. In addition, trails should aim to avoid transition zones between two or more native plant communities (called ecotones) because such areas are often ecologically important to native wildlife species. Rather than parallel habitat edges, trails should cross ecotones in locations where impacts to wildlife and their habitat can be minimized.

To reduce environmental impacts, planners should identify alternative locations for trails where the Jordan River Parkway Trail (1) is vulnerable to erosion due to proximity to the river bank, (2) represents a barrier to wildlife movement, or (3) restricts water movement between the river and adjacent wetlands.

BENEFIT

- Opportunities for recreation, fitness, and transportation
- Enhanced knowledge, understanding, and stewardship of the corridor
- Contributions to the regional transportation network
- Provides education opportunities

IMPLEMENTATION REQUIREMENTS AND COST

- Vegetation and wildlife habitat mapping
- Identify users and their activity needs
- Regional transportation and connectivity analysis
- Materials analysis and appropriate application
- Vegetation management

HOW TO

- Consider FEMA's floodplain requirements to avoid locating a trail in a floodplain, and reduce the risk of costly relocation or regulatory violation
- Consult local, state, and federal regulations along water bodies when locating a trail
- Avoid locating trails in the river buffer zone to maximize river meander and minimize potential damage during floods
- Develop trails in areas that already have human impacts and avoid sensitive environments and important wildlife habitat
- Avoid locating trails in the transition zone (ecotone) between two different plant communities
- Use natural infiltration and stormwater best practices in trail design
- Vary the distance from the river to provide variety and interest
- Avoid placing trails close to the river on an outside bend
- Decommission poorly located trails and restore them to a natural state
- Identify important view sheds to preserve and manage vegetation and to maintain visual access to the river

LONG-TERM MANAGEMENT

- On-going stewardship of trail and adjacent natural system
- Management and control of the spread of invasive species along the trail corridor
- Maintenance of positive drainage and stormwater to reduce impacts to trail

RESOURCES

- Salt Lake County Jordan River Trail Master Plan, June 2008
- Salt Lake County Natural Areas Land Management Plan Standards and Operation Manual. Dec 2007
- Minnesota Department of Natural Resources. 2006. Trail Planning, Design, and Development Guidelines



*Local Project Success:
Jordan River Trail
Photograph by Adriaan Boogaard*

ASSOCIATED BEST PRACTICES:

- L** Protect undisturbed areas
- E** Improve natural river function
- E** Manage invasive and nuisance species
- E** Enhance connectivity between habitat patches
- R** Provide river access where appropriate
- R** Provide east-west trail connections from developed areas to Jordan River
- S** Minimize impervious surfaces

INTEGRATE ACTIVE RECREATION THAT MAINTAINS RIVER FUNCTION AND WILDLIFE



*Local Project Success:
Murray Fish Pond
Photograph by Nancy Monteith*

WHY IS THIS BEST PRACTICE IMPORTANT?

Integrating recreational areas into natural systems can help improve urban runoff, infiltrate rainwater, and improve flood management while also providing contact with nature and beautiful landscapes

DESCRIPTION

Green infrastructure is the integration of natural systems and engineered solutions to create landscapes that provide quality habitat, cleaner water and air, and an overall better quality of life. Large open spaces for sports fields, informal play, and golf can be designed to enhance groundwater recharge, reduce urban heat island, and potentially enhance habitat connectivity. Open areas and active recreation fields can become stormwater detention basins that can mitigate high volumes of stormwater runoff and attenuate and treat pollutants before reaching the river. Planting native species rather than horticultural varieties can reconnect remnant habitat patches, thereby improving wildlife corridors and contributing to a sense of place. High quality open spaces increase nearby property values, improve natural systems that restore hydrological balance, and reduces community dependence on costly engineering systems.

Although large open spaces for sports fields, informal play, and golf can minimize impacts on river function and wildlife, traditional maintenance practices for these areas can have a negative effect on the river environment. Runoff from extensive use of fertilizers and pesticides can damage river water quality. Therefore, minimizing the use of fertilizers and pesticides in open space areas, designing open turf areas to avoid drainage into the river, and minimizing conventional practices such as mowing and pruning by integrating native species with open areas can reduce contaminants into the Jordan River.

BENEFIT

- Sustainable recreation facilities
- Enhanced aesthetic experience of the river environs and varied experiences
- Improved water quality
- Protection of natural areas

IMPLEMENTATION REQUIREMENTS AND COST

- Lower lifetime costs
- Reduced off-site costs
- Functional use of open space land

LONG-TERM MANAGEMENT

- Management of invasive species
- Management of stormwater facilities
- Management of turf and natural areas

HOW TO

New parks and recreation facilities:

- Locate park land between developed areas and the river
- Use open areas and athletic fields as stormwater detention areas, while maintaining field quality and playability
- Avoid draining turf areas directly into the river by providing a berm or swale to capture runoff from turf areas where fertilizers are used
- Reduce manicured turf to a functional minimum and use turf grasses that require minimal mowing, pruning, and fertilizing
- Reduce pavement and make surfaces permeable
- Protect as much native and sensitive habitat as feasible; enhance native areas with additional planting of native vegetation
- Enhance wildlife habitat potential by connecting river buffer zones and river adjacent swales or wetlands to existing parks, golf courses, and other recreational facilities using native plant species

Retrofitting existing recreation facilities:

- Reduce manicured turf to a functional minimum and plant native cover to reconnect remnant habitat patches
- Incorporate surface stormwater management, such as swales, to intercept stormwater before it reaches the natural areas

Maintenance practices for manicured space and recreation fields:

- Compost lawn clippings and vegetation debris for incorporation into urban soils and reduce use of and dependence on fertilizers
- Develop an Integrated Pest Management (IPM) plan to reduce use and dependence on pesticides
- Train staff in sustainable management practices and recognize employees for achieving sustainability goals

RESOURCES

- Salt Lake County Watershed Stewardship Plan
- Minnesota Department of Natural Resources. 2006. Trail Planning, Design, and Development Guidelines.
- Pacific West Region's 100+ Best Management Practices: Defining What a Green Park Looks Like

ASSOCIATED BEST PRACTICES:

- L** Protect undisturbed areas
- E** Improve natural river function
- E** Manage invasive and nuisance species
- E** Enhance connectivity between habitat patches
- R** Locate trails that protect river and habitat
- S** Manage stormwater with alternative system designs and strategies
- S** Minimize impervious surfaces

PROVIDE EAST-WEST CONNECTIONS FROM DEVELOPED AREAS TO THE JORDAN RIVER TRAIL

RECREATION

R

WHY IS THIS BEST PRACTICE IMPORTANT?

The Jordan River Trail is a regional recreation facility and an important active transportation feature for our region. Developing more east-west connections from neighboring communities and regional transportation nodes, such as TRAX stations, encourages use of active and alternative transportation and enhances accessibility for all.

DESCRIPTION

Communities have voiced avid appreciation of the Jordan River Trail and the desire for more east-west connections. New connections could be in the form of both on-street and off-street trails that serve a variety of user groups. Connecting the Jordan River Trail to regional transportation nodes further reduces parking pressure in proximity to the river corridor. The linking of trail systems on both local and regional levels creates a unique and robust comprehensive trail system.

BENEFIT

- Alternative and active transportation encouraged
- Enhanced recreation access for a diverse and broader user group
- Reduced parking pressure in proximity to the Jordan River

IMPLEMENTATION REQUIREMENTS AND COST

- Community transportation assessment
- Regional transportation and connectivity analysis
- Way finding signage
- Vegetation management

LONG-TERM MANAGEMENT

- On-going stewardship of trail and adjacent natural system
- On-going maintenance of trail, including snow removal, and vegetation management
- Maintenance of signage and maps

RESOURCES

- Jordan River Parkway Trail Map, printed June 2012
- Salt Lake County Bicycle Best Practices
- Trail Planning, Design, and Development Guidelines. Minnesota Department of Natural Resources. 2006
- Utah Bicycle & Pedestrian Master Plan Design Guide, Utah Department of Health. 2011

HOW TO

- Involve community stakeholders in the trail planning process
- Encourage cities to construct bike lanes and paths that connect light rail stations to the Jordan River trailheads
- Incorporate trail connections as a part of any new development or redevelopment projects
- Create connections via both on-street and off-street trails, depending on site opportunities
- Create a gateway element at the intersection of east-west community trails and the Jordan River Trail
- Avoid sensitive environments and habitats and encourage trail construction in previously disturbed areas
- Improve safe public access to the Jordan River Trail on existing roads by providing bike lanes
- Incorporate regionally standardized way-finding, regulatory, and interpretive signage



The Fairpark Station on Utah Transit Authority's "Green" light rail line provides a convenient connection to the Jordan River trail. The Jordan River is featured in the station artwork, alerting transit riders that the Jordan River is nearby. The artwork shares images of the river's history, and the native birds and recreation opportunities one can experience in the river corridor today. Image credit: UTA



Local Project Success:
9-line Trail, Salt Lake City
Photograph by: Kelly Gillman

ASSOCIATED BEST PRACTICES:

- L** Encourage clustered development to protect open space
- L** Protect undisturbed areas
- E** Manage invasive and nuisance species
- R** Integrate active recreation that maintains river function and wildlife
- S** Minimize impervious surfaces

STORMWATER

Local Project Success:

*UTA's Mid-Jordan Light Rail Project wetland mitigation site
Murray, Utah*



ROLE OF STORMWATER IN JORDAN RIVER WATER QUALITY

Stormwater from most of the urban areas in the greater Salt Lake valley flows to the Jordan River and eventually to the Great Salt Lake. Stormwater discharges affect the Jordan River by carrying pollutants, including sediment, organic matter (leaves and grass) debris, fertilizers, pesticides, and other pollutants.

Stormwater best practices are often focused on improving the water quality of low-flow stormwater runoff, which occurs when concentrations of pollutants are highest. Low impact, innovative on-site design techniques can effectively manage low flows. However, high flow runoff events have the potential for contributing significant quantities of organic matter and sediment to the Jordan River. Treatment wetlands are effective at treating high flow runoff. This document will broadly discuss several types of best practices and refer the reader to more detailed federal and local guidance manuals for the specific best practice details.

BEST PRACTICES FOR EXISTING FACILITIES AND NEW DEVELOPMENT

Stormwater best practices can be implemented on both existing sites and facilities as well as new developments. Existing sites benefit by retrofitting existing facilities to further increase the quality of water that is discharged. New projects that implement low-impact stormwater management in the design and planning of new projects not only improve the water quality that is discharged, but also create innovative high-quality places.

Retrofitting existing basins and infrastructure with best practices can improve water quality and help manage the flow off-site. Any stormwater best practice could be used in conjunction with an existing stormwater facility. This includes such projects as adding restrictive devices to the outlet of an existing detention basin to contain floating contaminants and debris, as well as many other techniques described here.

Stormwater best practices incorporated in the planning and design of new development can mitigate the quality and quantity of stormwater generated before it enters the river. Alternative systems and strategies for new development include wet and dry detention basins, vegetated swales, rain gardens, wetland restoration, and enhancement. Minimizing impervious surfaces can be accomplished through active construction or simply increasing landscaping or open space.

MAINTENANCE OF STORMWATER BEST PRACTICES IS ESSENTIAL FOR SUCCESS

It is important to maintain stormwater best practices so they function as designed. This is most successful when personnel are assigned and dedicated to this function. Landscaped best practices (wet ponds, buffers, swales and constructed wetlands) require

weed control, grass maintenance, and trash and debris removal activities. Best practices to remove sediment may require more frequent cleaning to keep the system free from clogging and blockage.

Maintenance of stormwater systems and best practices include inspections, illegal and illicit programs, public education, and pollution prevention activities. Public awareness and availability of household hazardous waste facilities are proven strategies to keep pollutants out of the storm drain system.

PARALLEL REGULATORY PROGRAMS

There are several regulatory programs that require municipalities and industries to acquire permits and maintain compliance that are associated with stormwater and the Jordan River. The State of Utah, Division of Water Quality, has a Storm Water Discharge Program that includes permitting requirements for construction activities, industrial activities, and Municipal Separate Storm Sewer (MS4). Stormwater Pollution Prevention Plans (SWPPP) are required for activities that have the potential of discharging sediment or other materials into stormwater. The Division of Water Quality also permits municipal and industrial wastewater discharges and facilitates a non-point source program to address runoff from agricultural sites. The Environmental Protection Agency has its Spill Prevention, Control and Countermeasure (SPCC) regulations that require facilities with potential contaminants stored in bulk on their property take measures to prevent spills and have plans in place to respond to spills. Storm drains to the Jordan River are permitted by the individual cities; Salt Lake County Flood Control; State Forest, Fires, and State Lands; State stream alteration; and potentially the U.S. Army Corps of Engineers.

According to the Draft Jordan River Total Maximum Daily Load (TMDL) Water Quality Study-Phase 1 dated July 27, 2012, segments of the Jordan River are listed on the State of Utah 303 (d) list of impaired waters for temperature, total dissolved solids (commonly known as salts), E. Coli, and dissolved oxygen. Through extensive data collection and analysis, modeling, and comprehensive stakeholder processes, it has been shown that excess organic matter loading is the most significant source leading to dissolved oxygen impairment. Whether from tree limbs, leaves, grass clippings, or smaller pieces, the accumulation of this organic matter in the low Jordan River requires a high oxygen demand. This ultimately creates a deficit of oxygen in the river, leading to an adverse environment for the fish and species that depend on this oxygen.

In this next phase of the TMDL, the Division of Water Quality, along with many of its stakeholders, is trying to determine where the largest loads of organic matter are entering the river and at what time of the year. While stormwater, tributaries, Utah Lake, return flows, and non-point sources contribute to these loads to the river, it is important to figure out where actions and best practices will most effectively decrease the loads.



*Local Project Success:
Huntsman Center Stormwater Detention Basins
University of Utah
Photography courtesy of the University of Utah*

BEST PRACTICES

Manage stormwater with alternative system designs and strategies

Retrofit existing stormwater facilities to incorporate water quality and quantity management

Minimize impervious surfaces

Provide staff to maintain stormwater best practices



Local Project Success:

*Jordan River Migratory Bird Reserve Wetland Habitat
Photograph by: Eric McCulley*

ASSOCIATED BEST PRACTICES:

- L** Encourage clustered development to protect open space
- E** Manage invasive and nuisance species
- R** Integrate active recreation that maintains river function and wildlife
- S** Minimize impervious surfaces

WHY IS THIS BEST PRACTICE IMPORTANT?

These practices reduce volume of stormwater as well as reduce sediment, heavy metals, oils and grease, and other float-able material. It has the greatest benefit within and close to the Jordan River corridor.

DESCRIPTION

This is a broad category covering numerous related best practices to manage stormwater and sediment discharge from developed areas and can be achieved through a number of strategies, including wet and dry detention basins, rain gardens, vegetated swales, wetland restoration enhancement, and low-impact development. The basic principles are to direct stormwater runoff to landscaped areas and stormwater features that retard runoff, reduce runoff volumes, attenuate peak flows, and encourage filtering and infiltration of stormwater. This also includes reducing the area of impervious surfaces. Mosquito abatement, land availability, and potential for and benefits of multiple uses should be considered. Detention basins can be sized for a range of stormwater events but the larger the basin, the greater the detention of runoff and the more effective at removing sediment.

BENEFIT

- Removal of sediments containing organic matter, non-soluble metals
- Removal of oils and grease
- Removal of other float-able materials
- Reduced downstream erosion potential
- Stormwater infiltrated at the source

IMPLEMENTATION REQUIREMENTS AND COST

- Capital cost: medium to high
- Operations and maintenance costs: medium to high

LONG-TERM MANAGEMENT

- Dependent on type
- Regular cleaning of structures
- Maintenance of vegetation

RESOURCES

- Salt Lake County Stormwater Best Management Practices
- EPA BMP Database and Water Quality Scorecard
- DWQ municipal permitting
- NPDES in Utah- Online permit applications

HOW TO

There are many types of stormwater systems and strategies that improve water quality and reduce quantity. Four types that are particularly applicable to the Jordan River system are described here.

Wetland restoration enhancement

Wetlands are shallow areas of permanent ponding used by fish, insects, and other animals for habitation. They can be newly constructed wetlands; restored historic wetlands; or existing wetlands that improve water supply, expand an area, or improve plantings. There are two types of wetland best practices, filtration and infiltration. Filtration wetlands have an outlet and the wetland is used for filtering stormwater through vegetation and by dilution. Infiltration wetlands allow water to seep through the soil profile. Both wetland types remove sediment, nutrients, pesticides, bacteria, and organic matter. If retention of stormwater is incorporated into the wetland, the treatment can be very high. Regardless of type, wetlands are among the best practices to treat a wide range of pollutants.

Rain gardens

Rain gardens are generally located at the point where stormwater terminates and infiltration occurs. This is a low collection point where garden or native type vegetation is planted. Rain gardens are a form of what is referred to as “bio-retention.” Rain gardens are used for small drainage areas and when soils allow for infiltration. These have a very high efficiency for treatment and would be one of the most beneficial methods to treat the dissolved solids that impair the Jordan River.

Vegetated swales

A vegetated swale is a trapezoidal or “V” ditch with heavy vegetation used to convey stormwater. The vegetation acts as a filter for stormwater and has a medium efficiency of removing Total Suspended Solids (TSS), nutrients, metals, and pathogens. This best practice is considered by Salt Lake County as having a high impact in treating stormwater. Using a vegetated swale can increase travel time to the river and, therefore, will lower the temperature when entering the Jordan River.

Wet and Dry detention basins

Extended detention basins are dry between storms but fill during a storm. A bottom outlet releases the stormwater slowly to provide time for sediments to settle. (Source: Guidance). Extended, or dry, detention provides opportunity for multiple uses as a recreational area or other uses when the basin is dry. Wet detention has water storage for other wet purposes (secondary irrigation, recreation) that also provides stormwater detention. Both types of detention treat for sediment, but wet detention treats for nutrients and organic material better than dry.

WHY IS THIS BEST PRACTICE IMPORTANT?

It is imperative to prevent illicit discharges, either intentional or accidental, from releasing to the Jordan River.

DESCRIPTION

Retrofitting an existing stormwater facility may, for example, include adding a snout to the outlet of a detention basin to control the release of floating oils, grease, or debris. It may also include the addition of best practices in series with an existing facility. This is important for any community or entity with responsibility for operating and maintaining best practices. Once best practices are constructed, a schedule of maintenance needs to be developed that documents maintenance activities

BENEFIT

- Removal of sediments
- Removal of oils and grease
- Removal of other float-able materials
- Reduced downstream erosion potential
- High positive impact from reducing or eliminating illicit discharge

IMPLEMENTATION REQUIREMENTS AND COST

- Capital cost: high
- Operations and maintenance costs: medium

LONG-TERM MANAGEMENT

- Regular clearing of outlet
- Sediment removal from storage basin
- Repair erosion
- Water circulation for water quality

RESOURCES

- Salt Lake County Watershed Stewardship Plan
- Salt Lake County Stormwater Best Management Practices
- Caltrans BMP treatment and Technology report, 2008

HOW TO

Almost all stormwater best practices can be used to retrofit existing facilities. Three that would provide benefits to the Jordan River system are described here:

Collecting stormwater for irrigation

Stormwater can be collected and stored for later use to irrigate parks, golf courses, and other open spaces. Irrigation using stormwater has benefit if irrigation practices are carefully controlled to avoid increasing pollutants. Properly applied, irrigation can remove and treat both suspended solids and dissolved solids, including nutrients, and can also dispose of waste stormwater unsuitable for discharge. Over irrigation and irrigation of over-fertilized lands may result in reduced water quality of return flows. Only properly and carefully managed irrigation with stormwater will improve water quality. It can be difficult to size storage for intermittent stormwater as a water supply. This strategy will also require alternative water sources for irrigation between storm events.

Dry weather screening

Dry weather screening provides a way to catch highly contaminated fluids from entering the Jordan River; it is a source control practice so it does not provide protection for stormwater treatment. Dry weather screening is the act of inspection and/or monitoring outfalls to the river, but not during storm events. This procedure can be critical to maintaining water quality in the river. Illicit discharge is any discharge to a storm drain that is not composed entirely of stormwater. Dry weather screening is a countermeasure to finding these discharges.

Oil/Water Separator

Oil/water separators are typically installed in-line and use the basic principle that the density of oil is lighter than water. This is generally done by using a box structure and allowing the oil to stay at the surface while the outlet may be submerged. These are effective for areas where oil and grease are present (i.e., streets, gas stations, parking areas, etc.) When runoff occurs along these types of surfaces, oil and grease will be picked up and conveyed downstream. These are also effective at removing trash and debris from entering the Jordan River. These come in a variety of types and costs. Some can be precast units while others can be a box with a prefabricated snout. Oil/water separators are for use in small areas where oil and grease are present (i.e., parking lots, streets, etc.) They are also effective at gas stations and vehicle maintenance or repair shops. Because oil/water separators are not effective at removing soluble contaminants, it is recommended these be used with other best practice treatments such as sand filters and extended detention basins. Emulsified oil will not separate in an oil/water separator.



*Local Project Success:
Washington Fields Detention Basin, Washington Utah
Photography by URS*

ASSOCIATED BEST PRACTICES:

- S** Manage stormwater with alternative system designs and strategies
- S** Minimize impervious surfaces

MINIMIZE IMPERVIOUS SURFACES

WHY IS THIS BEST PRACTICE IMPORTANT?

Minimizing impervious surfaces reduces sediment, heavy metals, oils and grease, and other float-able material and has greatest benefit in and close to the Jordan River corridor.

DESCRIPTION

Minimizing directly connected impervious areas is a structural best practice strategy requiring a basic change in drainage design philosophy. The basic principle is to direct stormwater runoff to landscaped areas, grass buffer strips, and vegetated swales to slow down the rate of runoff, reduce runoff volumes, attenuate peak flows, and encourage filtering and infiltration of stormwater, which also includes reducing the area of impervious surfaces.

Low-impact development is the design of combining stormwater conveyance and treatment together. This is achieved by using alternate hardscape surfaces, such as pervious pavement, grassy waterways, micro detention, and retention. It is also a "...design approach that uses land use planning, treatment best practices, and other design detailing to concurrently reduce the load of pollutants to surface waters and reduce the duration and magnitude of stormwater ...” (Source: Caltrans)

Minimizing hardscape and incorporating low impact development techniques reduces the volume of stormwater and intensity of pollutants to the river. Surface stormwater management offers short-term savings in minimizing piping and long-term savings in maintenance.

BENEFIT

- Removal of sediments
- Removal of oils and grease
- Removal of other float-able materials
- Reduction in downstream erosion potential

IMPLEMENTATION REQUIREMENTS AND COST

- Capital cost: medium
- Operation and maintenance costs: medium

LONG-TERM MANAGEMENT

- Landscape maintenance
- Periodic maintenance of porous paving such as vacuuming to maintain porosity

HOW TO

Reduce overall amount of hardscape surfaces:

- Reduce width of streets
- Install green roofs on buildings
- Consider soft surfaces for trails
- Replace existing paving with lawn, landscaping or pervious pavers
- Reduce parking requirements and implement shared parking
- Encourage shared right-of-way
- Reduce or eliminate curbing in low impact storm drainage developments

Install porous paving:

- Evaluate soils for appropriate drainage
- Limit permeable paving to slopes less than 5%
- Permeable paving is best for low traffic areas such as pedestrian circulation, parking stalls and low traffic roads
- Install appropriate paving profile that includes: appropriate site conditions and soil permeability, filter fabric, drainage rock and wearing surface that can be pavers, porous concrete or crushed stone



Pervious pavement is an effective way to reduce runoff where hard surfaces are needed. Pervious pavement does require periodic maintenance to preserve its porosity and effectiveness.



Landscaping can creatively incorporate detention basins to reduce runoff and filter stormwater.

ASSOCIATED BEST PRACTICES:

- L** Encourage clustered development to protect open space
- E** Manage invasive and nuisance species
- R** Integrate active recreation that maintains river function and wildlife
- S** Minimize impervious surfaces

RESOURCES

- Salt Lake County Storm Water Guidance
- Sustainable Sites Handbook
- Salt Lake Countywide Water Quality Stewardship Plan, 2009
- Why and How to Reduce the Amount of Land Paved for Roads and Parking Facilities. Environmental Practice. 2011

WHY IS THIS BEST PRACTICE IMPORTANT?

Maintenance of stormwater facilities and flood control is critical to maintaining water quality that enters the Jordan River system. The function of many stormwater best practices is to remove sediments or other contaminants from runoff, resulting in an accumulation of those sediments and contaminants in the stormwater facility. Cleaning out the facilities is essential to maintaining their effectiveness and function.

DESCRIPTION

Several communities adjacent to the Jordan River have dedicated staff for the maintenance of stormwater best practices throughout their communities. Staffing at this level ensures best practices are monitored and maintained as needed to ensure their functionality. Data on stormwater best practices are preserved in a database to ensure their maintenance continues following staffing changes. Any method that ensures maintenance of facilities would qualify as meeting this best practice.

Communities establish maintenance regimes that describe both the activity and its frequency. Examples of stormwater best practice maintenance activities include street sweeping; road maintenance; catch basin cleaning; maintenance of all other alternative systems such as swales, education programs, outfall structure protection, and maintenance; household hazardous waste and yard waste pickups; and pharmaceutical drug collection.

BENEFIT

- Removed sediment and contaminants from stormwater best practices so they continue to function effectively
- Systematic method of monitoring best practices to ensure facilities are maintained and not overlooked

IMPLEMENTATION REQUIREMENTS AND COST

- Capital cost: none
- Labor costs: relatively high if staff are dedicated to stormwater facility maintenance
- Database establishment costs: moderate
- Database maintenance costs: low

HOW TO



Camera inspection of a stormwater facility
Source: blog.udot.utah.gov

LONG-TERM MANAGEMENT

The purpose is to provide long-term management of best practices

RESOURCES

- Known examples of full- or part-time staff dedicated to stormwater facilities monitoring and maintenance include Salt Lake County, South Salt Lake City, West Valley City, and Sandy.



Local Project Success:
Ogden River Restoration - Stormwater outfall
Photograph by Ben Nadolski

ASSOCIATED BEST PRACTICES:

- S Manage stormwater with alternative system designs and strategies
- S Retrofit existing stormwater facilities to incorporate water quality and quantity management
- S Minimize impervious surfaces

UTILITIES

*Local Project Success:
Rocky Mountain Power Corridor Restoration
Taylorsville, Utah
Photograph by Adriaan Boogard*



WHY IS THIS BEST PRACTICE IMPORTANT?

Numerous utility corridors exist in and cross the Jordan River corridor, including electrical transmission lines, storm water piping and outfalls, gas pipelines, sewer and water pipelines, and transportation corridors. Reducing their construction and maintenance impacts and planning for multiple use corridors that include recreation and wildlife habitat will improve the corridor.

DESCRIPTION

New construction, improvements to existing facilities, and maintenance of utility infrastructure often result in negative impacts on the corridor. Coordinated planning and design can mitigate construction impacts by minimizing construction footprint, reducing spread of invasive species, and restoring native plant communities. Consideration of multiple-use opportunities in the planning and design of access roads provides benefits to both the utility and the surrounding community.

Mitigating the effects of new facilities and improvements to existing facilities should be considered in the planning and design phases, as well as in facility siting, construction access, and restoration of the construction footprint. Necessary improvements to existing facilities often create as much construction impact as construction of new facilities. Access of large construction equipment and transportation of materials may require clearing of mature vegetation and construction of new access roads to support heavy loads. Construction may also disrupt the connectivity of recreational trails, as well as disrupt natural plant and animal communities.

BENEFIT

- Protection and enhancement of natural resources
- Minimized impacts from new, as well as existing infrastructure

APPLICATION

- Planning and design in vicinity of new and existing facilities
- Construction of new facilities
- Improvement of existing facilities
- Natural river flow and habitat development

RESOURCES

- Powering Our Future: Salt Lake County Electrical Plan Local Planning Handbook, September 2010
- Pipeline safety report, Salt Lake City
- CGA (Common Ground Alliance) Best Practices

HOW TO

Construction of new facilities and improvements to existing facilities:

- Work with local general plans and planning organizations and stakeholders in the site selection of new facilities; avoid siting utilities in areas with flood, landslide, and earth movement potential
- Share rights-of way with other utilities such as roads, canals, and railroads; utilize land adjacent to other infrastructure
- Develop construction plan to reduce the amount of access roads required to improve the facilities; utilize existing roads for construction
- Ensure any new utility crossings do not create the potential for new navigational hazards, as water flow will eventually expose buried pipes
- Identify and protect significant view sheds and visually mitigate impacts of new facilities
- Protect the natural landscape, critical habitats, wetlands, and the river corridor during construction and restore construction footprint with natural vegetation; utilize buffer zones to protect and enhance existing natural areas
- Design long-term maintenance access in collaboration with community recreation needs
- Maximize tower span length at river crossing and limit tower height in river corridor

Management, maintenance, and mitigation of existing facilities:

- Reinforce any pipelines intersecting the river, wetlands, or riparian corridor to prevent accidental failure and contamination of the water or river corridor
- Frequently inspect and test all utilities intersecting the river or riparian corridor to prevent failure and negative impacts to river corridor or water
- Utilize utility buffer zone to improve natural habitat areas
- Mitigate visual impacts of overhead transmission lines by restoring natural plant communities and habitat patches
- Utilize “wire-border zone” to plant native species
- Feather vegetation in right-of-way to reduce the appearance of straight lines of vegetation



*Local Project Success:
Legacy Utility Line Construction
Removable roadway placed on ground to facilitate access for large equipment so damage to site is minimized.
Photograph by Eric McCulley*

ASSOCIATED BEST PRACTICES:

- L** Protect undisturbed areas
- L** Enhance river buffer
- E** Manage invasive and nuisance species
- E** Enhance connectivity between habitat patches
- S** Minimize impervious surfaces

IMPLEMENTATION REQUIREMENTS AND COST

- Variable

GLOSSARY

*The Yellow Canoe Cafe
On the Rideau Canal Waterway
Merrickville, Canada*



Brush Layering A revegetation technique that combines layers of dormant or rooted cuttings with soil to stabilize streambanks and slopes.

Buffer Land that is used to protect adjacent water features from development and more intensive land uses. The land is kept in a generally natural state of trees, shrubs, and low ground cover and understory of plants. It functions to filter runoff, control sediment and nutrient movement, and protect fish and wildlife habitat.

Conservation Easement A legal agreement between a landowner and a land trust or other qualified organization by which the landowner voluntarily limits the development potential and use of his or her land, which typically results in property tax and estate tax reductions for the landowner.

Cluster Subdivision A subdivision design technique that concentrates buildings in specific areas on a site to allow the remaining land to be used for recreation, common open space, preservation of environmentally sensitive areas, or agricultural uses.

Constructed Wetlands Man made wetlands designed and constructed to manage and filter stormwater through the use of aquatic plants.

Density Bonus The allowance of additional development potential, such as dwelling units or commercial floor area, for a particular property in exchange for some public benefit (e.g., protection of open space) in compliance with clearly defined zoning requirements.

Dissolved Solids Elements that were once solid, such as salts, that are in solution in water.

Ecosystem A community of animals and plants interacting with one another and with their physical environment, and includes physical and chemical components (i.e. soils, water, and nutrients).

Ecosystem Functions Exchanges of energy, nutrients, and wastes between living and non-living components within an ecosystem.

Ecosystem Services Processes by which the environment produces resources such as clean water, timber, habitat for fisheries, and pollination of native and agricultural plants.

Ecotone A transitional area of vegetation between two different plant communities, containing characteristics of each bordering community. May contain a higher density of organisms of one species and a greater number of species than adjacent communities.

Edge Effects The negative influence of a habitat edge on interior conditions of the habitat or on species that use interior habitat.

Eutrophication A natural, slow aging process of a water course in to a bog or marsh, associated with an abundance of plant life due to higher levels of nutritive compounds such as nitrogen and phosphorus. Human activities can accelerate the process, leading to rapid algal growth and hypoxia.

Fragmentation The disruption of extensive habitats into isolated and small patches; or the result of development in a large area where habitat is now fragmented into separate units.

Footprint The area of land surface on the site that will be covered by the planned building.

General Plan Each city and county in Utah is required to prepare and adopt a “comprehensive general plan” to deal with the growth occurring within its boundaries. The role of a general plan (or comprehensive plan) is to plan for the physical development of the community. Typically, a general plan is future-oriented because it projects the development of a community to a future point in time. It also covers the jurisdiction’s entire geographic area and all of the physical elements that determine future community development.

Green Infrastructure Techniques that use vegetation, soils, and natural processes to manage stormwater and create healthier urban environments.

Green Site Design Techniques that modify the location, type, and relationship of development improvements to reduce impacts on environmental resources, such as water, soil, air, and wildlife.

Habitat The area or environment where an organism or ecological community normally lives or occurs.

Habitat Connectivity	Describes the degree to which the landscape facilitates animal movement and other ecological flows.	Land Trust	A land trust is a nonprofit organization that, as all or part of its mission, actively works to conserve land and water by undertaking or assisting in the acquisition of land or conservation easements, and often by its stewardship of such land or easements. In doing so, land trusts work closely with landowners and the community to conserve land by accepting donations of land, purchasing land, negotiating private, voluntary conservation agreements on land, and stewarding conserved land in perpetuity.
Habitat Patch	An area of distinct habitat type separated from other areas of suitable habitat by areas of non-usable habitat.	Low Flow Stormwater	Stormwater that is not associated with a large event, typically 10-year frequency rainfall events or less.
Hydrologic Regime	The distribution over time of water in a watershed, among precipitation, evaporation, soil moisture, groundwater storage, surface storage, and runoff.	Low Impact Development (LID)	Innovative techniques that work with nature to reduce the amount of stormwater close to its source and improve its quality.
Illegal and Illicit Discharge Prevention	Enforcement programs to prevent, stop, or capture those that illegally discharge to stormwater facilities significant pollutants.	Macroinvertebrate	Organisms without backbones that are visible to the naked eye.
Incentive	In the context of land development, it is a financial or procedural advantage provided by a zoning code to a landowner in exchange for the landowner providing some type of public benefit for the community (e.g., green infrastructure) as part of a new development.	Meander Corridor	The zone within which the river channel may reasonably be expected to migrate during the next 100 years.
Indicator Species	A species whose presence, absence, or relative well-being in a given environment is indicative of the health of its ecosystem as a whole. A species used to locate another, less visible species.	Native Species	A species that occurs naturally with respect to a particular ecosystem, rather than as a result of an accidental or deliberate introduction into that ecosystem by humans.
Infill	New development on vacant or mostly vacant land located within heavily developed areas and where infrastructure is usually already in place.	Nonconformity	Development (usually a building or use) that complied with the zoning laws in existence when the development was approved but does not comply with current regulations due to a subsequent change in the zoning requirements.
Infrastructure	Public improvements for water, sewer, drainage, streets, sidewalks, and similar facilities.	Non-point Source Pollution	Sources of pollution dispersed and concentrated at a single point.
Integrated Pest Management (IPM)	An ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques that are selected to minimize risks to human health, and benefit non-target organisms and the environment. Techniques include biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties.	Organic Matter Loading	Carbon-based matter that is discharged to a water body.
Invasive Species	An non-native (alien) species whose introduction does cause or is likely to cause economic or environmental harm or harm to human, animal or plant health.	Overlay District	A unique set of zoning regulations that are superimposed on one or more established zoning districts and shown on the zoning map, and subsequently impose in addition to or in place of the regulations of the underlying district. Developments within an overlay district must conform not only to the requirements of the overlay but to the requirements of the underlying district as modified (or not) by the overlay district.

Rain Gardens Small low lying areas designed to infiltrate stormwater and filter pollutants, typically planted with wetland species.

Redevelopment Any proposed expansion, addition, renovation, or major change to an existing building, structure, or aspect of development.

Return Flows Water, such as irrigation, which is not consumed by evapotranspiration and is returned to a water body after use.

Riparian Buffer Vegetated areas next to water resources that protect water resources from nonpoint source pollution and provide bank stabilization and aquatic and wildlife habitat.

Riparian Habitat Habitat located on the bank of a natural watercourse (as a river) characterized by dense vegetation. The width of a riparian zone can vary.

River Reach Any length of a stream between any two points. The points may be selected for any reason, such as gaging stations, river miles, natural features, and topography.

Setback The required unoccupied open space between a structure and the property line of the lot on which the structure is located.

Snout A mechanical device to help separate floating debris, oil, and sediment from stormwater.

Species Diversity The number of species in a region or area and their relative abundance.

Species Richness The number of species in a region or area.

Stream Reach A continuous part of a stream between two specified points selected for monitoring. Often contains riffles and pools and should be perennial.

Storm Water Pollution Prevention Plan (SWPPP) A required plan by the State Division of Water Quality to control erosion and sediment laden runoff from construction sites.

Sustainability Creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations.

Total Maximum Daily Load (TMDL) The amount of pollution that regulating agency has determined as the maximum amount of a pollutant that a receiving water can accept without impairment to the purposes of the water body as defined by a regulating agency.

Transfer of Development Rights (TDR) A program where development rights (usually for dwelling units) can be transferred from a one location, called the “sending area,” to another location in the community, called the “receiving area.” The purpose is to transfer development from land that the community wants to protect for environmental, agricultural, scenic, or some other reason and relocate it to already developed areas where additional development is desired, such as a downtown location.

Upland Habitat Habitats bordering freshwater wetlands and comprised of vegetation such as grasslands, woodlands, and/or wetland/riparian plant species.

Vegetated Soil Lift A bioengineering technique that uses coir fabric or coir logs to form a stream bankline and structural support and prevent fine sediments from washing out.

Vegetative Swales A trapezoidal or “v” ditch vegetated and designed to convey stormwater and to remove nutrients, metals, and pathogens from stormwater.

Wet and Dry A best management practice that is a basin designed to temporarily store stormwater runoff. Wet detention as continuous water storage and only the upper reach of the basin used for stormwater storage.

Detention Basins

Wet Ponds A best management practice that is a basin to manage stormwater and prevent flooding. They are generally wet as opposed to only occasionally wet; they may not include any detention storage capacity.



Mechanism	Encourage clustered development to protect open space	Embrace the river as an amenity	Enhance river buffer	Encourage green site design and management practices	Protect undisturbed areas	Improve natural river function	Improve bank stability	Manage invasive species	Enhance connectivity between habitat patches	Improve and restore native plant diversity	Provide river access where appropriate	Integrate active recreation that maintains river function and wildlife	Provide east-west connections from developed areas to the Jordan River Trail	Locate trails to protect river and habitat	Alternative stormwater management and design	Retrofit existing stormwater facilities	Minimize impervious surfaces	Provide staff to maintain stormwater best practices	Minimize impacts of utility corridors
Cross Jurisdictional Stakeholders *																			
Long range regional planning																			
Capital project construction																			
Local Government - Planning																			
General or other long range plans																			
Capital improvement plans																			
Resource management plans																			
Redevelopment area plans																			
Local Government - Regulations																			
Development review process																			
Zoning ordinance																			
Subdivision ordinance																			
Sensitive lands ordinance																			
Enforcement																			
Developers, Builders, Engineers, and Architects																			
Site planning and design																			
Development agreements																			
Conservation easements																			
Homeowner Associations																			
Covenants, codes and restrictions (CC&Rs)																			
Open space and sensitive area management																			
Property Owners **																			
Ongoing property maintenance and upkeep																			

This chart is intended to illustrate the relationship between the entities and mechanisms for implementing the Best Practices. Generally, most best practices will involve the application and coordination of multiple mechanisms and entities to ensure successful implementation.

The colored columns include each best practice category and tool in the guide. The rows show the primary mechanism (e.g., ordinances, plans, or other document) and type of entity (e.g., local government, developer, homeowners association, etc.) that might be involved in implementing that best practice.

* Cross Jurisdictional Stakeholders include federal agencies, transportation agencies, metropolitan planning organizations, and utility companies

** Property Owners include private (residential, commercial and agricultural), cities, counties, state agencies, federal agencies, utility companies, canal companies, and non-profits

The Jordan River Commission encourages all cities and counties within the Jordan River Watershed to adopt an ordinance based upon these Best Practices for Riverfront Communities, and one that is tailored to each community's individual goals and situations.

This is an outline of a model riparian protection ordinance. While not designed for any particular community, the model is intended to illustrate a basic structure that can be modified by any community to meet their needs. In addition, sample language from adopted riparian ordinances is included to show examples of how each section has been addressed in other communities.

1. PURPOSE

An effective ordinance should begin with a purpose statement that describes the community's reasons and goals for protecting riparian habitats. It may contain general statements related to protecting the health, safety, and welfare of the community, as well as more specific statements regarding why riparian habitats are important for that particular community, such as habitat for important local species, flood control, water quality, etc. The purpose statement should link the ordinance to the applicable enabling authority.

Example language can be found in italics throughout this outline.

“Purpose: The purpose of this Section is to protect and enhance riparian areas by instituting standards for preservation of riparian habitats associated with watercourses and significant stands of native vegetation in order to: Protect the valuable, limited and endangered natural riparian habitat resources of the Town;

- 1. Provide an ecologically sound transition between riparian habitat communities and developed/developing areas;*
- 2. Assure the continuation of existing or natural functions, values and benefits provided by riparian habitat resources;*
- 3. Protect aesthetic and environmental values of riparian habitats for the enjoyment of residents and visitors; and,*
- 4. Maintain linear continuity for riparian habitat.” (Oro Valley, Arizona)*

2. APPLICABILITY

An applicability section should state generally where the riparian protections will apply and/or what types of development are subject to the ordinance. While specific details may need to be provided in the body of the ordinance, this section

should provide enough detail to let readers know whether their project needs to comply with the ordinance.

“Any changes to land or development within the greenway zones, including rights-of-way, are subject to the development standards of this chapter.” (Portland, Oregon)

In addition, the applicability section should list all geographic areas, activities, and circumstances that are exempt from and do not have to comply with the riparian standards.

“This Chapter shall not apply to any construction related to the provision of alternative water supplies including, but not limited to, facilities for the purposes of groundwater recharge, groundwater savings and the enhancement of riparian and environmentally sensitive areas.” (Oro Valley, Arizona)

3. MAP

If there is a map that depicts where the regulations apply, such as with an overlay district, then it should be identified to help the reader understand where the ordinance applies. The map should be either included in the ordinance or adopted by reference.

“The NRO District is shown on the Official Zoning District Map. The NRO District of the Official Zoning District Map includes the general location of (1) migration routes and crucial winter ranges of elk, (2) migration routes and crucial winter ranges of mule deer, (3) crucial winter habitat of moose, (4) nesting areas and winter habitat of trumpeter swans, (5) spawning areas of cutthroat trout, and (6) nesting areas and crucial winter habitat of bald eagles. ” (Teton County, Wyoming)

Because large-scale riparian maps are often created using remote and incomplete data, it is important that a technical process exist for individual landowners to verify or challenge the inclusion of their property in the protected area.

“Any Boundaries and Delineations required under the Riparian Corridor Overlay (RCO) shall be prepared by a licensed professional Hydraulic Engineer, Hydrologist, Wetlands Scientists, Fluvial Geomorphologist or other

equivalent qualified environmental science professional. All delineations are subject to the approval of the Public Utilities Director.” (Salt Lake City, Utah)

“... A site specific analysis is required prior to development pursuant to Division 3100, Environmental Analysis, specifically to identify any NRO lands and apply the appropriate NRO standards to the development. (Teton County, Wyoming)

4. PERMIT REQUIRED

If the jurisdiction chooses to require landowners to obtain a specific permit to build in protected riparian areas, then the type of permit (e.g., zoning certificate, conditional use permit, etc.) and the required review process should be provided.

“Development, exterior alterations, excavations, or fills within the greenway setback that are river-dependent or river-related may be allowed if approved through greenway review, unless exempt under Section 33.440.320, Exemptions. Development, exterior alterations, excavations, or fills that are not river-dependent or river-related require greenway review and a Greenway Goal Exception to locate in the greenway setback.” (Portland, Oregon)

5. HABITAT /NATURAL RESOURCE ANALYSIS

It is common to require applicants with proposed projects located in the riparian protection zone to submit a resource inventory and impact analysis for the property. Also, as described in more detail below, this analysis may also include a required mitigation plan that proposes a strategy for avoiding, minimizing, and if required, mitigating impacts to the protected features.

“Any Boundaries and Delineations required under the Riparian Corridor Overlay (RCO) shall be prepared by a licensed professional Hydraulic Engineer, Hydrologist, Wetlands Scientists, Fluvial Geomorphologist or other equivalent qualified environmental science professional. All delineations are subject to the approval of the Public Utilities Director.” (Salt Lake City, Utah)

6. GENERAL STANDARDS

This section provides the bulk of the substantive requirements for riparian protection. The length and detail of this section will vary significantly depending on the goals of each jurisdiction.

A. Buffer Zones

A common option is to divide the riparian buffer zone into zones so that the areas closest to the river have stricter standards than the areas on the outer reaches of the zone. For example, areas within 50 feet of the river may restrict all development, areas from 51 to 100 feet may allow very limited development, and areas from 101 to 150 feet may allow most development subject to additional standards. Some codes use a uniform-sized buffer zone.

The Salt Lake City Riparian Protection Ordinance divides the regulated riparian corridor into the following three buffer zones; 1) Zone A (No Disturbance Area): 0 – 25 feet; 2) Zone B (Structure Limit Area): 25 – 50 feet; and 3) Zone 3 (Buffer Transition Area) 51- 100 feet. (Salt Lake City, Utah)

B. Protected Riparian Features

This section lists each protected riparian feature and describes clearly what special or additional standards are required to protect them from new development. Typical standards might address:

1. Special conditions for grading, structures, and roads;

“... Excavations and fills are prohibited except in conjunction with approved development or for the purpose of wildlife habitat enhancement, riverbank enhancement, or mitigating significant riverbank erosion.” (Portland, Oregon)
2. Native vegetation protection and weed control;

“All landscaping must comply with the native plant requirement of the Willamette Greenway Plan.” (Portland, Oregon)

“Development shall be sited and designed to protect native grassland areas.” (Santa Barbara County, California)
3. Reduction or limitation on impervious surfaces;

Parking may not exceed 120 percent of the required permitted parking. (Duluth, MN)

The use of pervious surfaces shall reduce on-site stormwater management requirements and/or impact fees. (Duluth, MN)

4. Operational restrictions;
“All permitted industrial and recreational uses shall be regulated both during construction and operation to protect critical bird habitats during breeding and nesting seasons. Controls may include restriction of access, noise abatement, and restrictions on hours of operations of public or private facilities.” (Santa Barbara County, California)
5. Recreational access and limits;
“Recreational trails must be designed to minimize disturbances on the natural environment of the River Natural and River Water Quality zoned lands.” (Portland, Oregon)
6. Project or subdivision design;
“No plat shall be approved by the Hearing Examiner covering any land situated in a riparian corridor, wetland and wetland buffer, or steep slope and steep slope buffer unless in compliance with the applicable provisions of Section 25.09.240, Short subdivisions and subdivisions, in environmentally critical areas.” (Seattle, Washington)
7. Fencing;
“Fencing shall comply with Section 49220, Wildlife Friendly Fencing.” (Teton County, Wyoming)
8. Land use restrictions; and
“Any land area located within an identified riparian habitat, per the adopted maps, or the required 15 foot apron area surrounding it in its entirety, shall be placed in common area and shall be labeled as a conservation easement....” (Oro Valley, Arizona)
9. Accommodation for essential or water-dependent facilities
“Certain water dependent uses and essential road or utility crossings must be located in or adjacent to waterbodies and/or in floodplains. These may be permitted provided all structures meet the following requirements....” (Teton County, Wyoming)

C. Alternatives Analysis

Some ordinances require the developer to submit one or more alternative site designs to determine whether such designs might reduce impacts to protected riparian resources in comparison to the proposed design. The alternatives may be used to justify modifications to the proposed development.

“Alternative site design analysis. Alternative site designs shall be developed by the consultant and Planning Director that shall be based on habitat-based considerations only; visual impacts to the landowner or potential effects on the market value of the property are not to be considered for this purpose. The impacts of development to protected resources shall be addressed for each alternative. The alternative site designs will be conceptual and schematic, consistent with Subsection 51200.E, Sketch Plan.” (Teton County, WY)

D. Mitigation Standards and Plan

When impacts to protected riparian resources are unavoidable, the jurisdiction may require that those impacts be mitigated. The mitigation plan will describe how the proposed development will be designed to avoid, minimize, and if required, mitigate the impacts to the protected features

“If it is determined that encroachment into identified riparian areas is to occur, a Riparian Habitat Study and Mitigation Plan must be prepared in accordance with the following requirements. Said study and plan must accompany any application for development (i.e. rezoning, conditional use permit, development plan and/or subdivision plat)...” (Oro Valley, Arizona)

“All significant detrimental impacts on functional values that cannot be avoided will be mitigated by meeting the requirements of Subsection 33.440.350.H” (Portland, Oregon)

7. MODIFICATION TO REQUIRED STANDARDS/ ALTERNATIVE COMPLIANCE

To provide flexibility and to allow alternative methods for compliance, many ordinances provide a process through which landowners may modify riparian requirements (subject to review, and within defined parameters) to respond to unforeseen circumstances on the ground or to allow innovative development techniques that meet or exceed the adopted standards.

Purpose

“Alternative equivalent compliance is a procedure that allows development to meet the intent of the design-related provisions of this chapter through an alternative design. An alternative equivalent compliance approach is designed to provide flexibility in order to respond to unique site conditions or abutting or surrounding uses, and must not result in reductions in the

amount or quality of the particular standard. This procedure is not intended as a substitute for a variance or administrative modification or a vehicle for relief from standards in this chapter.” (Henderson, NV)

Criteria

“To grant a request for alternative equivalent compliance, the Zoning Administrator shall find that the following criteria are met:

- 1. The proposed alternative design achieves the intent of the subject design standard to the same or better degree than the subject standard;*
- 2. The proposed alternative design achieves the goals and objectives of the Comprehensive Plan, other relevant plans, and this Code to the same or better degree than the subject standard;*
- 3. The proposed alternative design results in benefits to the community that are equivalent to or better than compliance with the subject design standard; and*
- 4. The proposed alternative design imposes no greater impacts on adjacent properties than would occur through compliance with specific requirements of Article 5, Design and Development Standards.” (Henderson, NV)*

8. ENFORCEMENT

This section should identify who is responsible for enforcing the riparian ordinance, what constitutes a violation of the ordinance, and the penalties and enforcement measures available in case of violations. If there are no special enforcement provisions that are unique to the riparian ordinance, then the ordinance may simply refer to the standard enforcement procedures and standards set forth in the zoning ordinance or other general regulations.

9. DEFINITIONS

This section should define all terms that are necessary to implement the riparian ordinance.



*Local Project Success:
New Roots Redwood Refugee Farm
Salt Lake County, Utah*

Despite significant urban development along the Jordan River, some farms and agricultural lands still survive within this heavily developed river corridor. They remain an important source of food and open space for the community and their protection from development should be a major priority for conserving the natural functions of the river corridor. Throughout the country, communities are struggling with ways to slow or prohibit the conversion of productive agricultural land to non-farm uses. In most cases, it is a joint effort of state and local programs, as well as non-profit organizations dedicated to protecting rural lands, such as land trusts.

There is no single solution or package of solutions that can be recommended automatically for the diverse communities along the Jordan River because each community will have to decide for itself how it wants to address agricultural protection. To help with this task, below is a summary of farmland protection techniques that have proven successful in many other communities. Before any steps can be taken, the community must first identify clearly which lands are considered “agricultural” for protection purposes. This is usually done based on soil productivity and existing uses. However, technical tools aside, the two key ingredients for success are the political will to impose new regulatory requirements on land in agricultural areas and the identification of revenue sources to implement the non-regulatory strategies.

ZONING TOOLS

Local zoning ordinances can be used as a primary tool for protecting farmland. The primary downside is that regulatory tools are not permanent because voters can change the rules in the future. Below are the more common and effective zoning-related strategies for this purpose.

Downzoning

This involves reducing the number of dwelling units allowed on the property, usually by increasing the minimum lot size to discourage subdivision and reduce development potential. To truly protect farms, lot sizes should be decreased to no less than 1 unit/20 acres in more urbanized areas, but likely should be significantly larger. Because this action reduces the landowner’s property value, it is usually politically controversial and should be done with careful analysis.

Limiting Non-farm Uses

This involves limiting or prohibiting most non-farm uses on agricultural lands, especially commercial uses. This also tends to reduce property value and can be politically controversial.

Growth Boundary

The community can create a clear boundary that separates urbanized (and soon-to-be urbanized) lands from areas, such as farmland, that should not be developed – at least not until the boundary is expanded over time and reaches the farms located closest to urbanized lands.

Allowing Farm-related Uses

Ensure that ancillary farm-related uses and accessory uses, such as farm stands, are allowed and easy to operate, maintain, and expand.

Conditions on Rezoning to Non-Agricultural Zone

Even if agricultural lands are properly downzoned and the uses are limited, the landowner can always apply for a rezoning to avoid these restrictions. In response, some communities have adopted regulations that prohibit the rezoning of agricultural zoned land unless strict criteria are met, such as requiring the applicant to prove that the land is better suited for non-agricultural uses, demonstrating that the land does not have more Class I, II, or III soils than a certain threshold (e.g., 50%), and that the rezoning would not allow uses that would conflict with existing agricultural uses.

Allow Dwellings for Family Members

Many farm families would like or need the help from other family members to keep the farm going and teach them the trade. Thus, some communities allow one (or two) additional dwelling units to be built on the property in addition to the primary structure, provided the additional dwellings are occupied by members of the family and cannot be subdivided into separate lots. This provides affordable housing for farm families and helps keep them together on the land.

Transfer of Development Rights

This allows farmers to sell and transfer development rights, often “lost” due to a downzoning, to other properties where development is more appropriate.

Additional Setbacks

Require larger setbacks on properties adjacent to major agricultural lands or operations to create a buffer and reduce conflicts.

Note: Annexation can be a real problem for farmland protection when the new community’s regulations are not as protective of farmland as those in the previous community.

NON-ZONING TOOLS

In addition to the zoning tools listed above, there are many other non-regulatory strategies for protection farmland that can often be combined with the zoning tools to maximize effectiveness.

Donation or Purchase of Agricultural Conservation Easements

Farmers either donate a conservation easement or another entity purchases the development rights on a farm to protect it from future development. In both cases, the farm is still owned and farmed by the landowner. Land trusts can play a major role, especially by identifying “conservation buyers” that will provide most if not all the money to protect a particular property.

Funding for Conservation

In order to raise funds to purchase development rights or entire properties, some communities pass local sales tax or property tax measures that can raise substantial sums for conservation.

Options with Right of First Refusal

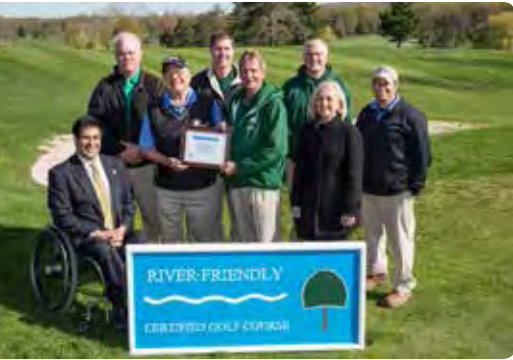
Local government, or other conservation entity, purchases an option that gives them the right of first refusal if the landowner chooses to sell the agricultural property. This gives the community the first chance to prevent unwanted development of the property.

“Right to Farm” Protections

Adopted by every state, and sometimes supplemented by local governments, these laws protect farmers from nuisance claims by neighbors for normal or statutorily defined farm operations and often against unreasonable local regulations.



*Local Project Success:
Drake Family Goat Farm in West Jordan, Utah
Photograph by Drake Family Farms*



COMMUNITY CHECKLIST

What sort of initiatives can a community engage in to protect and enhance the Jordan River corridor?

The intent of this checklist is to provide a tool for a community to evaluate their level of commitment to the Jordan River. Many best practices exist to change our traditional way of doing business and address the needs of the river by increasing natural and man-made habitat and/or buffers, improving water quality and quantity, creating diverse recreation opportunities, reducing impacts from the built environment, and enhancing the quality of life and attractiveness of our communities.

This checklist is not meant to cover every potential best practice in the realm of possibility concerning the river. It is meant to be a starting point to help communities achieve a new level of engagement with the river. As communities become more involved and find new techniques to protect and enhance the river, the checklist will expand.

YES Address the General River Environment through Community Building Strategies

- 1. Address the river in the community’s General Plan and set goals of protection and enhancement that align with the Blueprint Jordan River. Add River areas and potential recreational use to the Parks and Recreation section of the Plan. Add goals to address stormwater runoff water quality and low impact, innovative on-site retention.
- 2. Develop or participate in community awareness building events and educational/promotional campaigns.
- 3. Participate in on-going regional committees.
- 4. Create ordinances and policies to build the community in a way that incorporates these best practices.
- 5. Consider innovative funding strategies and incentives for river projects.
- 6. Evaluate and then work toward implementing priority river enhancing projects.
- 7. Provide access to the river with adjacent TRAX stations and bus routes.
- 8. Encourage access for recreational use through local trail connections.
- 9. Encourage infill, redevelopment, and more concentrated development patterns to protect existing river buffers.

- 10. Encourage homeowners to retrofit their property to retain and utilize rain water to reduce stormwater.

YES Address the River and its Meander Corridor

- 11. Consider funding or participating in river bank improvements such as bank stabilization, terracing, and revegetation.
- 12. Clear the river of hazards and undertake efforts to prevent new hazards from forming.
- 13. Encourage development projects to be located outside of the natural river meander corridor through incentives or regulation.
- 14. Encourage compatible land uses near the river through zoning.

YES Address and Enhance Natural Environment Buffers

- 15. Retain and/or enhance existing buffers through ordinances, clustering, density bonuses, TDRs, infill, and other incentives and zoning strategies.
- 16. Focus on creating larger buffers. A minimum of 50-feet is essential, and buffers of 150-feet and larger provide significant opportunities for greater bio-diversity, recreation, and natural flood control.
- 17. Seek grants, partner with other agencies and communities, and consider other funding sources to acquire buffer and open space property.
- 18. Create links between buffer habitat patches.
- 19. Manage invasive and nuisance species and litter.
- 20. Consider the use of impact fees for additional land purchases along the river.
- 21. Adopt a tree protection and replacement ordinance.
- 22. Revegetate disturbed or weedy areas to provide native plant diversity.

YES Address Manicured Open Space and Agriculture

- 23. Provide connections between park spaces and the river corridor.
- 24. Design multi-functional parks that can provide emergency flood water detention.
- 25. Provide active recreation in appropriate ways that reduce its impact on river buffers.
- 26. Incorporate natural features within park spaces as well as provide buffers between the park and river.

This checklist is provided as a guide for communities wishing to evaluate their progress towards incorporating these Best Practices into local decision-making, planning, and management.

- 27. Adopt appropriate practices for the use of pesticides and fertilizers in parks to protect river water quality.
- 28. Manage invasive and nuisance species.
- 29. Assure that buffers are provided in agricultural areas.

YES Address the Built Environment

- 30. Promote a low impact, innovative site design and stormwater philosophy that embraces the idea of river corridor enhancement.
- 31. Adopt new ordinances for development that require minimizing impervious surfaces and on-site retention through low impact, innovative development strategies
- 32. Reward developers with incentives that accomplish or exceed recommended best practices.
- 33. Design stormwater facilities to achieve a higher level of filtration and infiltration.
- 34. Retrofit existing basins to improve water quality and allow for aquifer recharge.
- 35. Design new and retrofit old streets with low impact, innovative techniques. Consider such techniques a standard part of a project's costs.
- 36. Consider expedited processing where early conceptual plans provide a high level of low impact, innovative design techniques.
- 37. Adopt a stormwater utility fee.
- 38. Provide staffing for maintenance of stormwater infrastructure.

YES Address Utility Corridors

- 39. Work with utility companies to improve the location and visual design of their installation/corridor.
- 40. Promote habitat enhancement within utility corridors.
- 41. Promote the incorporation of recreational trails and other potentially compatible uses within utility corridors.



Like similar community recognition programs, the Jordan River Commission encourages the cities and counties within the Jordan River Watershed to become a “River Friendly Community” by adopting an ordinance based upon the Best Practices, and demonstrating implementation of the Best Practices through management practices or long range plans.

*Contact us for more information:
www.jordanrivercommission.com*

COMMUNITY DEVELOPMENT CHECKLIST

How can the development process increase river buffers and improve the built environment through enhanced site design and on-site management of stormwater?

The intent of this checklist is to provide potential best practices that a community can add to their existing development application processes. There are many successful techniques being used to upgrade site design and stormwater components, which reduce impacts to the Jordan River and its tributaries. Most communities have development review checklists already in place, and these items are suggested additions to those existing application documents.

While prepared specifically for the Jordan River corridor, most of these best practices are widely applicable within the entire community.

DEMONSTRATE ON YOUR SITE PLAN AS MANY OF THESE AS POSSIBLE

Low impact, innovative site techniques (may be used to offset recreation impacts and fees)

1. Is stormwater being collected, stored and reused on the site? Please describe.
2. Has a percentage of the potential hard surfaces been proposed and clearly identified as permeable? If so, what percent?
3. Have appropriate drought resistant plantings been proposed in areas receiving on-site waters?
4. Has a green roof been proposed?
5. If located adjacent to the river, has the development: Provided a natural buffer? Proposed to enhance an existing buffer? Embraced the river in any unique manner?
6. Is bicycle use being encouraged through project design? Is a trail connection proposed?
7. Are areas of appropriate and native vegetation being retained?
8. Identify, avoid, and potentially enhance any existing wetlands or riparian areas on the site.
9. How will barren areas or areas significantly impacted by noxious weeds be revegetated?
10. How are sloped areas being addressed to prevent erosion?

11. Are parking lots drained to internal landscaped islands, or are they constructed with pervious pavement materials? How will pervious surfaces be cleaned and maintained?
12. Are shade trees included in the islands?
13. Can a reduction of standard parking requirements be considered for the site? If so, provide studies and/or data to support the reduction?
14. Are parking lots designed to encompass the smallest possible area?
15. For residential uses, have clustering techniques been employed to preserve existing riparian areas or to provide a buffer?

Stormwater designs – Creates the potential for a reduction in fees

16. Are slotted curbs with adjacent swales and/or rain gardens proposed to accept street runoff?
17. Is the collected stormwater being filtered, and then infiltrated into the ground?
18. Provide calculations to show that all water from parking areas is being retained on site within parking lot landscaped islands or adjacent rain gardens.
19. How will stormwater collection areas be maintained?
20. Are permeable surfaces proposed for all sidewalks – on site and off site? How will pervious surfaces be cleaned and maintained?
21. Are reduced street widths proposed?
22. Are shared driveways proposed?
23. Are reduced driveway widths proposed? For residential use, can double track driveways be incorporated into the site design?
24. If oil and water separators are needed, how will they be maintained?

This Community Development Checklist is envisioned to be used in two ways:

1. *By architects, builders, and engineerings as they are planning their projects, and*
2. *By local governments as a project review checklist within a development application process.*

ADDITIONAL TECHNICAL RESOURCES AND REFERENCES

LOCAL AND REGIONAL PROJECT EXAMPLES

INTRODUCTION AND GENERAL REFERENCES

- CH2M Hill. 1992. Jordan River Stability Study. Prepared for Salt Lake County.
- Costanza, R., R. d’Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, S. Naeem, K. Limburg, J. Paruelo, R.V. O’Neill, R. Raskin, P. Sutton, and M. van den Belt. 1997. The value of the world’s ecosystem services and natural capital. *Nature* 387: pp. 253-260. May 15, 1997.
- Ecological Society of America. 1997. *Issues in Ecology*. “Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems, No. 2, Spring, <http://www.esa.org/sbi/issue2.htm>.
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- Miller, J.R. 2006. Restoration, reconciliation, and reconnecting with nature nearby. *Biological Conservation* 127: 356-361.
- Miller, J.R. 2005. Biodiversity conservation and the extinction of experience. *Trends in Ecology and Evolution*, 20 (8): pp. 430-434.
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- Pickett, S.T.A., M.L. Cadenasso, J.M. Grove, C.H. Nilon, R.V. Pouyat, W.C. Zipperer, and R. Costanza. 2001. Urban Ecological Systems: Linking Terrestrial Ecological, Physical, and Socioeconomic Components of Metropolitan Areas. *Annual Review of Ecology, Evolution, and Systematics* 32: pp. 127–57.
- Utah Department of Environmental Quality, Division of Water Quality. 2012. *Draft Jordan River Total Maximum Daily Load Water Quality Study*.

N/A

ENHANCE RIVER BUFFER

- K.A. Smith Consulting, Inc. 2011. *Jordan River Open Space and Habitat Conservation Master Plan and Management Guidelines*. Available at www.sjc.utah.gov/recreation/. Accessed May 2013.
- Johnson, Craig and S. Buffer. 2008. *Riparian Buffer Design Guidelines for Water Quality and Wildlife Habitat Functions on Agricultural Landscapes in the Intermountain West*. USDA General Technical Report RMRS-GTR-203.
- Boise, Idaho; Boise River System Overlay Districts
- Denver, Colorado; Platte River
- Planning Development Services (Boulder, Colorado) and Biohabitats Inc. 2007. *Wetlands and Stream Buffers: A Review of the Science and Regulatory Approaches to Protection*. Available at www.bouldercolorado.gov/files/PDS/wetlands/bjwetlandbuffers_report.pdf. Accessed May 2013.

- Salt Lake City – Riparian Corridor Overlay District
- Ogden River Restoration – Ogden City
- Provo River Restoration Project (PRRP) – Below Jordanelle Reservoir, Utah Reclamation Mitigation Conservation Commission
- Legacy Nature Preserve – Utah Department Of Transportation (UDOT), Davis County and the Nature Conservancy
- Little Cottonwood Creek between mouth of canyon and communities – Salt Lake County Watershed Planning and Restoration Program
- Boise River- City of Boise, Idaho
- South Platte River- City of Denver, Colorado

ADDITIONAL TECHNICAL RESOURCES AND REFERENCES

LOCAL AND REGIONAL PROJECT EXAMPLES

PRESERVE UNDISTURBED AREAS

- Summit County, Colorado (wildlife habitat protection overlay)
- Tucson, Arizona (native plant preservation ordinance)
- Division of Forestry, Fire and State Land, Utah Department of Natural Resources. 2006. Galena Property Management Plan. Available at: http://www.ffsl.utah.gov/sovlands/Galena_cmp.pdf. Accessed May 2013.
- Hoven, H. M., H. O’Brein, L. Sperry, J. Reed, and B. Nicholson. 2007. Legacy Nature Preserve Habitat Management Plan, Available at: www.udot.utah.gov/main/. Accessed May 2013.
- K.A. Smith Consulting, Inc. 2011. Jordan River Open Space and Habitat Conservation Master Plan and Management Guidelines. Available at www.sjc.utah.gov/recreation/. Accessed May 2013.

- Legacy Nature Preserve – UDOT, Davis County and the Nature Conservancy
- Jordan River Migratory Bird Reserve – U.S. Fish and Wildlife Service (USFWS), Great Salt Lake Audubon, Utah Reclamation Mitigation and Conservation Commission (URMCC)
- Galena Restoration Project, UDOT, Utah Division of Forestry, Fire and State Lands (FFSL), Utah Department of Natural Resources
- Swaner Nature Preserve and EcoCenter – Utah State University
- Provo River Restoration Project – URMCC
- Midvale wetland – Salt Lake County (restoration and planning)

ENCOURAGE CLUSTERED DEVELOPMENT TO PROTECT OPEN SPACE

- Riley County, Kansas, subdivision regulations
- Sheridan County, Wyoming, Conservation Design Subdivision
- McMahon, T. Edward. 2010. Conservation Communities: Creating Value with Nature, Open Space and Agriculture. Urban Land Institute.
- Economy League of Greater Philadelphia, Econsult Corporation, Keystone Conservation Trust. 2011. The Economic Value of Protected Open Space. Available at <http://jordanrivercommission.com/documents/>. Accessed May 2013.

- Jordan Willows residential community – Lehi, Utah
- Spring View Farms, residential community – Bluffdale, Utah
- Parry Farms, approximately 15000 South to 15700 South. 1800 West to Jordan River (about 1300 West.)
- Swaner Preserve and EcoCenter, Utah State University New Park Resort Residences and Foxpointe at Redstone Condominiums, Kimball Junction, Utah
- Ogden Riverfront – Ogden, Utah
- Daybreak New Community – Kennecott Land

EMBRACE THE RIVER AS AN AMENITY

- San Antonio, Texas, River Improvement Overlay District (more urban context)
- Dallas, Texas/North Texas: Trinity River initiative

- Radius Engineering – 1042 West 2780 South, – South Salt Lake, Utah
- Jordan Willows residential community – Lehi, Utah
- Ogden Riverfront – Ogden, Utah
- Pagoda Park, Disc Golf – Holladay, Utah
- Sugarhouse Park – Salt Lake City, Utah
- International Peace Gardens – Salt Lake City, Utah
- Spring View Farms, residential community – Bluffdale, Utah
- Murray City (by Kennecott nature center)

ADDITIONAL TECHNICAL RESOURCES AND REFERENCES

LOCAL AND REGIONAL PROJECT EXAMPLES

ENCOURAGE GREEN SITE DESIGN AND MANAGEMENT PRACTICES

- Calkins, M. 2012. The Sustainable Sites Handbook. Wiley.
- Portland, Oregon, (green roofs, rain gardens, pervious pavement, stream protection)
- Emeryville, California, (green infrastructure design guidelines)
- Lancaster, Pennsylvania, (Green Infrastructure Plan)
- Green Infrastructure: A Landscape Approach, American Planning Association. PAS Report 571.

- Associated General Contractors (AGC) building in Metro Business Park – West Valley City, Utah
- LDS Conference Center green roof
- Utah House – Utah Botanical Center
- Daybreak New Community – Kennecott Land
- Central Utah Water Conservancy District (CUWCD) Gardens, Weber Basin
- Jordan Valley Water Conservation District (JVWCD) Conservation Garden Park Demonstration Park
- Sego Lily Gardens – Sandy City Public Utilities

IMPROVE NATURAL RIVER FUNCTION

- CH2M Hill. 1992. Jordan River Stability Study. Prepared for Salt Lake County.
- National Audubon Society. 2000. The Jordan River Natural Conservation Corridor Report. Available at http://www.mitigationcommission.gov/wetlands/pdf/wetlands_jornac.pdf. Accessed May 2013.
- ESA - Ecosystem Services. (www.esa.org).
- Center for Watershed Protection. (www.cwp.org/).
- Salt Lake County Watershed Planning and Restoration Program. (www.watershed.slco.org/index.html)
- SWCA Environmental Consultants. 2007. Legacy Nature Preserve Comprehensive Water Management Plan. Available at www.udot.utah.gov/main/uconowner.gf?n=1927752816403691464. Accessed May 2013.

- Walden Park – Murray City and Salt Lake County
- South Jordan – rechanneling and stabilization project – 10600 South area, includes opening up an old oxbow
- Ogden River Restoration – Ogden City
- Hobble Creek – Utah County
- Provo River Restoration Project (PRRP)- Below Jordanelle Reservoir, URMCC
- Bingham Junction – Midvale, Utah
- Redwood Nature Center – Salt Lake County
- Murray – Merabahn
- 114000 South – north natural stream braids
- Riverbend Restoration Project, Salt Lake County, 13000 South, Streambank Stabilization and Re-vegetation.
- Johnson Creek – Portland, Oregon

ADDITIONAL TECHNICAL RESOURCES AND REFERENCES

LOCAL AND REGIONAL PROJECT EXAMPLES

IMPROVE BANK STABILITY

- Salt Lake County and Stantec Consulting. 2009. Salt Lake Countywide Water Quality Stewardship Plan. Available at www.watershed.slco.org/wtrQualSteward/. Accessed May 2013.
- USDA - Monitoring the Vegetation Resources in Riparian Areas.
- Streambank Soil Bioengineering Available at www.nh.gov/dot/org/projectdevelopment/highwaydesign/documents/StreamlineSoilBioEng.pdf. Accessed May 2013.
- Bentrup, G., and J.C. Hoag, Chris, 1998, The Practical Streambank Bioengineering Guide. User's Guide for Natural Streambank Stabilization Techniques in the Arid and Semi-arid Great Basin and Intermountain West. USDA Natural Resources Conservation Service Plant Materials Center, Aberdeen, Idaho.

- Walden Park – Murray City and Salt Lake County, and Utah Transit Authority
- South Jordan – rechanneling and stabilization project – 10600 South area, includes opening up an old oxbow,
- Modesto Park 900 South, American Recovery and Reinvestment Act (ARRA) Project, Salt Lake City
- Provo River Restoration Project (PRRP), URMCC
- Swaner Nature Preserve East Canyon Creek Restoration Project, Snyderville Basin
- Riverbend Restoration Project, Salt Lake County, 13000 South, Streambank Stabilization and Re-vegetation.

MANAGE INVASIVE AND NUISANCE SPECIES

- Salt Lake County and Stantec Consulting. 2009. Salt Lake Countywide Water Quality Stewardship Plan. Available at www.watershed.slco.org/wtrQualSteward/. Accessed May 2013.
- SWCA Environmental Consultants. 2012. Noxious and Invasive Weed Management Plan for Salt Lake City Parks and Public Lands. Available at www.slcdocs.com/openspace/SLCOS_IPMP_040313_FINAL.pdf. Accessed May 2013.
- Bio-West, Inc. 2007. Salt Lake County Natural Areas Land Management Plan Standards and Operation Manual, Available at www.recreation.slco.org/parks/pdf/NatAreasLMP1.pdf. Accessed May 2013.
- Website: surveyor.slco.org/flexviewer_weeds/index.html
- The National Invasive Species Council (NISC). 2008-2012 . National Invasive Species Management Plan. Available at www.invasivespecies.gov/home_documents/2008-2012%20National%20Invasive%20Species%20Management%20Plan.pdf. Accessed May 2013.
- NISC - Invasive Species Definition Clarification and Guidance White Paper
- http://www.grandcanyontrust.org/research/wp-content/uploads/2010/02/WFF_ERW-Beaver-Restoration-Efforts_2013_03_13.pdf.
- www.econw.com/media/ap_files/ECONorthwest_Publication_Escalante-Beaver-Values_2011-10.pdf
- wildlife.utah.gov/furbearer/pdf/beaver_plan_2010-2020.pdf.
- www.beaversww.org/assets/PDFs/BetterWaysToManageUtahsBeavers.pdf.

- Walden Park –Murray City and Salt Lake County
- South Jordan invasive species eradication and re-vegetation plan, Salt Lake City ARRA
- Legacy Nature Preserve – UDOT, Davis County, and the Nature Conservancy
- Jordan River Migratory Bird Reserve – Great Salt Lake Audubon, USFWS, URMCC
- Galena Restoration Project –UDOT, FFSL, Utah DNR
- Little Cottonwood Confluence Site, 4800 South, Taylorsville City and Salt Lake County

ADDITIONAL TECHNICAL RESOURCES AND REFERENCES

LOCAL AND REGIONAL PROJECT EXAMPLES

E	<p>ENHANCE CONNECTIVITY BETWEEN HABITAT PATCHES</p> <ul style="list-style-type: none"> Wasatch Front Regional Council. 2012. (Re)Connect: The Wasatch Front Green Infrastructure Plan. Johnson, C. and S. Buffler. 2008. Riparian Buffer Design Guidelines for Water Quality and Wildlife Habitat Functions on Agricultural Landscapes in the Intermountain West. USDA General Technical Report RMRS-GTR-203. Environmental Protection Agency – Buffer Width and Nitrogen Removal Effectiveness, EPA/600/R-05/118. Beier and Lowe. 1992. A checklist for Corridors National Audubon Society. 2000. The Jordan River Natural Conservation Report. EPA Ecological restoration (water.epa.gov/type/wetlands/restore/principles.cfm) GIS tools for designing wildlife Corridors (http://corridordesign.org/) 	<ul style="list-style-type: none"> Walden Park – Murray City and Salt Lake County South Jordan mitigation wetlands and the Jordan River Migratory Bird Reserve (JRMBR), South Jordan City, Great Salt Lake Audubon (GSLA), USFWS, URMCC. Galena Restoration and Soo’khani Wetlands, Bluffdale, UDOT, FFSL, Utah DNR Dimple Dell Park – Salt Lake County Legacy Nature Preserve – UDOT, Davis County and the Nature Conservancy Swaner Nature Preserve and EcoCenter – Utah State University, Kimball Junction
E	<p>IMPROVE AND RESTORE NATIVE PLANT DIVERSITY</p> <ul style="list-style-type: none"> Jordan River Migratory Bird Reserve Operations and Management Plan, June 2013 Salt Lake County and Stantec Consulting. 2009. Salt Lake Countywide Water Quality Stewardship Plan. Available at www.watershed.slco.org/wtrQualSteward/. Accessed May 2013 K.A. Smith Consulting, Inc. 2011. Jordan River Open Space and Habitat Conservation Master Plan and Management Guidelines. Available at www.sjc.utah.gov/recreation/. Accessed May 2013 Salt Lake County Natural Areas Land Management Plan Standards Manual, December 2007 Ohio State University Extension – Managing Wildlife Habitat on Public Open Space (http://ohioline.osu.edu/b915/part_four.html) Audubon International Programs (www.auduboninternational.org/programs) National Oceanic and Atmospheric Administration Habitat Conservation and Restoration Center (www.habitat.noaa.gov/restoration/techniques/srrestoration.html) 	<ul style="list-style-type: none"> Walden Park – Murray City and Salt Lake County South Jordan Mitigation Wetlands – South Jordan City Glendale 2000 South ARRA – Salt Lake City Ogden River Restoration – Ogden, Utah Provo River Restoration Project – Utah Reclamation Mitigation Conservation Commission Jordan River Migratory Bird Reserve – USFWS, Great Salt Lake Audubon, URMCC Legacy Nature Preserve – UDOT, Davis County and the Nature Conservancy Redwood Nature Center – Salt Lake County, Tree Utah 900 South Oxbow – Salt Lake City Parks and Public Lands Bend in the River – Salt Lake City Parks and Public Lands Division and the University of Utah Lowell Bennion Center

ADDITIONAL TECHNICAL RESOURCES AND REFERENCES

LOCAL AND REGIONAL PROJECT EXAMPLES

R	<p>PROVIDE RIVER ACCESS WHERE APPROPRIATE</p> <ul style="list-style-type: none"> National Park Service: Rivers, Trails, and Conservation Assistance Program. 2004. Logical Lasting Launches: Design Guidance for Canoe and Kayak Launches. Salt Lake County and Landmark Design. 2008. Salt Lake County Jordan River Trail Master Plan. Available at http://www.recreation.slco.org/planning/PDFdocs/0_CocAckTblConts.pdf. Accessed May 2013. 	<ul style="list-style-type: none"> Canoe Marina, 1700 South, Raging Waters Arrow Trailhead – Riverton City Ogden River between Washington and Wall Avenue Springville City, Hobble Creek Murray, south of Vine Winchester Park
R	<p>LOCATE TRAILS TO PROTECT RIVER AND HABITAT</p> <ul style="list-style-type: none"> Minnesota Department of Natural Resources. 2006. Trail Planning, Design, and Development Guidelines. Salt Lake County and Landmark Design. 2008. Salt Lake County Jordan River Trail Master Plan. Available at www.recreation.slco.org/planning/PDFdocs/0_CocAckTblConts.pdf. Accessed May 2013. Salt Lake County. 2007. Salt Lake County Natural Areas Land Management Plan Standards and Operational Manual. 	<ul style="list-style-type: none"> T&T Auto Wetland Mitigation Project – Salt Lake City Open Space Jordan River Equestrian Trail – Murray, Utah, and Salt Lake County Parks Antelope Island Shoreline Trail – Utah State Parks Provo River Parkway Trail – Provo, Utah Jordan River Parkway 12300-Bangerter – Salt Lake County Parks
R	<p>INTEGRATE ACTIVE RECREATION THAT MAINTAINS RIVER FUNCTION AND WILDLIFE</p> <ul style="list-style-type: none"> Calkins, M. 2012. The Sustainable Sites Handbook. Wiley Grave, C.J.; MLA Thesis. July 2003. Wildlife Habitat Enhancement Alternatives: A Case Study of Riverbend Golf Course, Riverton, Utah- Part 1, Part 2, Part 3, Part 4, Part5, Part 6. MLA Thesis, Utah State University. Available at jordanrivercommission.com/documents/. Accessed May 2013. 	<ul style="list-style-type: none"> Sandy Fish Pond – Sandy City, Utah Murray Fish Pond – Murray City, Utah Redwood Nature Park – West Valley City, Salt Lake County South Jordan Fish Pond – South Jordan, Utah Daybreak parks and open space – Kennecott Land Kayak park, Weber River Silver Lake at Brighton Silver Creek in Park City International Peace Gardens – Salt Lake City, Utah Reno – Truckee River Animas River kayak park – Durango, Colorado

ADDITIONAL TECHNICAL RESOURCES AND REFERENCES

LOCAL AND REGIONAL PROJECT EXAMPLES

R

PROVIDE EAST-WEST TRAIL CONNECTIONS FROM DEVELOPED AREAS TO THE JORDAN RIVER TRAIL

- Salt Lake County Planning and Development Services, 2012. Salt Lake County Bicycle Best Practices. Available at www.pwpds.slco.org/zoning/pdf/121003_BBP_FINALwCOV.pdf. Accessed May 2013.
- Salt Lake County and Landmark Design. 2008. Salt Lake County Jordan River Trail Master Plan. Available at www.recreation.slco.org/planning/PDFdocs/0_CocAckTblConts.pdf. Accessed May 2013.
- Jordan River Commission and National Park Service Rivers and Trails Conservation Assistance Program. 2012. Jordan River Parkway Trail Map. Available at jordanrivercommission.com/jordan-river-parkway-trail-map/. Accessed May 2013.
- Weber Pathways organization (www.weberpathways.org)
- Parley's Trail. (www.parleystrail.org/)

- Jordan Willows Planned Unit Development trail – Lehi, Utah
- 9 Line trail – Salt Lake City, Utah
- 11400 South and Jordan River – South Jordan
- Parleys Trail – PRATT Coalition
- Provo River Parkway Trail – Provo, Utah
- Legacy Parkway Trail – Davis County

S

MANAGE STORMWATER WITH ALTERNATIVE SYSTEM DESIGNS AND STRATEGIES

- Salt Lake County and Stantec Consulting. 2009. Salt Lake Countywide Water Quality Stewardship Plan. Available at www.watershed.slco.org/wtrQualSteward/. Accessed May 2013.
- Salt Lake County Stormwater Best Management Practices. (www.pweng.slco.org/stormwater/html/guide.html)
- EPA BMP Database and water quality scorecard. <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm>
- Utah Department of Water Quality (DWQ) – municipal permitting. DWQ – municipal permitting
- National Pollutant Discharge Elimination System (NPDES) in Utah – Online permit applications. www.waterquality.utah.gov/UPDES/stormwater.htm

- Stormwater ponds across from Gardner Village – South Jordan, Utah
- West Jordan City Wetlands 7800 South – West Jordan City, Salt Lake County
- Rain Gardens and porous pavement – University of Utah Campus
- 900 South water quality treatment wetlands – Salt Lake City, Utah
- Ogden River Restoration – Ogden, Utah
- Jordan Valley Water Conservation District (JVWCD) conservation garden
- Legacy Highway – UDOT, Davis County, Nature Conservancy
- Wasatch Touring pervious pavement – Wasatch Touring
- Taylorsville City Hall
- U of U Warnock Engineering Building, WEB, new Meldrum CE Building
- Daybreak new community – Kennecott Land

ADDITIONAL TECHNICAL RESOURCES AND REFERENCES

LOCAL AND REGIONAL PROJECT EXAMPLES

S	<p>RETROFIT EXISTING STORMWATER FACILITIES TO INCORPORATE WATER QUALITY AND QUANTITY MANAGEMENT</p> <ul style="list-style-type: none"> • Salt Lake County and Stantec Consulting. 2009. Salt Lake Countywide Water Quality Stewardship Plan. Available at www.watershed.slco.org/wtrQualSteward/. Accessed May 2013. • Salt Lake County Stormwater Best Management Practices. (www.pweng.slco.org/stormwater/html/guide.html) 	<ul style="list-style-type: none"> • South Jordan detention basin enhancements • Mystic Springs Wetland Education/Interpretative area – Shields Lane and 700 W • South Jordan Fish Pond – South Jordan, Utah • SLC sewer treatment facility, wetland on north side of building • Galena Storm drain 10600 South – South Jordan City, URMCC • Willow Creek in South Jordan 11000 South – USFWS, Great Salt Lake Audubon
S	<p>MINIMIZE IMPERVIOUS SURFACES</p> <ul style="list-style-type: none"> • Salt Lake County and Stantec Consulting. 2009. Salt Lake Countywide Water Quality Stewardship Plan. Available at www.watershed.slco.org/wtrQualSteward/. Accessed May 2013. • Salt Lake County Stormwater Best Management Practices. (www.pweng.slco.org/stormwater/html/guide.html) • EPA Low Impact Development (LID) Website:http://water.epa.gov/polwaste/green/ • Calkins, M. 2012. The Sustainable Sites Handbook. Wiley. • Litman, Todd. 2011. Why and How to Reduce the Amount of Land Paved for Roads and Parking Facilities. Environmental Practice. Available at www.vtpi.org/EP_Pav.pdf. Accessed May 2013 	<ul style="list-style-type: none"> • AGC building in Metro Business Park – West Valley City, Utah • University of Utah Campus • Utah Museum of Natural History – University of Utah • JWCD conservation garden • Daybreak new community – Kennecott Land • International Center by airport – Salt Lake City, Utah
S	<p>PROVIDE STAFF TO MAINTAIN STORMWATER BEST PRACTICES</p> <ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • Salt Lake County • South Salt Lake City, • West Valley City • Sandy
U	<p>MINIMIZE THE IMPACT OF UTILITY CORRIDORS</p> <ul style="list-style-type: none"> • Rocky Mountain Power. 2010. Powering our Future, Salt Lake County Electrical Plan Local Planning Handbook. Salt Lake County Electrical Plan. Available at www.cooperativeplan.slco.org. Accessed May 2013. • Pipeline Safety Trust. 2012. Pipeline safety in the Salt Lake Valley. Available at: http://pstrust.org/docs/SLC_Report_webres.pdf. Accessed May 2013. • CGA (Common Ground Alliance) Best Practices 9.0 (www.commongroundalliance.com). 	<ul style="list-style-type: none"> • Legacy Nature Preserve – UDOT, Davis County and the Nature Conservancy • Galena Storm drain – South Jordan City, URMCC , North of 10600 South. • Sandy suburban water sewer line



OUR RIVER
OUR FUTURE

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