JORDAN RIVER COMMISSION

BEST PRACTICES
FOR RIVERFRONT COMMUNITIES

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

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Acknowledgments Page - In Progress

INTRODUCTION

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

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 Wasatch and Oquirrh Mountains feed directly in to 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 2010. 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.

INTRODUCTION

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. As urban development expanded throughout Salt Lake and Utah valleys, the Jordan River's ability to respond to flood events has greatly diminished.

Over the last one hundred and fifty years residents of the valleys sought to control the Jordan River by channelizing it and developing structures and agricultural uses adjacent to its river banks. This alteration of the river has reduced its ability to respond to high intensity flows and results in periodic flooding. The flooding impacts community facilities, infrastructure and residences often results in damages. The National Flood Insurance Program (NFIP) delineates a flood area that has a statistical chance of occurring 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 1920's, 1950's, and 1980's with focused efforts on straightening the Jordan River and improving the capacity to "keep the floodwaters in the channel".

The more recent response to the 1980's flood initiated a "meander study" to understand the river function and developed recommendations for river management. These recommendations could enhance public health and safety as well as techniques to minimize damage to expensive public and private infrastructure. The studies included strong recommendations for recognizing the natural river meander corridor and designating open space activities in those areas which are meant to flood during extreme periodic events. The study, however, was not implemented in a comprehensive manner.

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

A BETTER WAY

Very little of the original conditions that encompassed 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 and protected 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 within 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
- enhanced open space habitats
- compatible recreation opportunities
- improved storm water 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. The best practices offer ways to enhance and maximize the River environment. The natural corridor provides relief from the urban environment and offers recreation opportunities for all ages and abilities. 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 enhances neighborhood and community economic value. practices across disciplines, departments, and communities to improve the quality of the Jordan River.

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INTRODUCTION

BEST PRACTICES FOR RIPARIAN CORRIDOR CONSERVATION AND DEVELOPMENT

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 that is based on sound environmental and engineering knowledge to be effective. Best Practices continue to evolve as new and better methods are discovered. The intent of the best practices is to strike a balance between the need for consistent developmental 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.

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 and public works staff
- Facilitating workshops with community stakeholders to identify content
- Creating a flexible tool box of Best Practices
- Providing opportunities for the public to give feedback on the documents
- Developing education and outreach tools for the community

HOW TO USE THIS DOCUMENT

The purpose of this document is 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 JORDAN RIVER GRAPH AS AN ORGANIZING ELEMENT

The Jordan River Graph on the following page illustrates the relationship of the land context and the best practice categories. Each section 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 four land use designations/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. The vertical and the horizontal axis are two different ways to access and understand the toolbox. It allows you to think about both the existing land use conditions and also the management objectives or goals you are trying to achieve.

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

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INTRODUCTION

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 document is organized around four land use designations and five land planning management objectives. There are two different ways to access the toolbox. Think about both the 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 that the practices address. They include:

RIVER:

This is the active river corridor. The river bottom is owned by the State Forestry, Fire, and Lands Division. Any work done within the bank-to-bank line of the river needs to be directly coordinated with State Forestry, Fire, and Lands Division. For this reason, the practices included in this document do not address the river but rather the 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 unaltered lands adjacent to the river provide valuable protection of river banks, mitigation of floods, and stability of the river. Protecting these areas with a river buffer ensure the protection of the resource. Protecting the river meander zone could include the natural environment buffer. 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:

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 tremendous potential to improve the overall function and quality of the Jordan River, including enhancing native vegetation and improving stormwater management through incorporating best practices. 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 already developed. Residential, both urban and suburban; 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. Areas that are already developed The Jordan River will benefit from retrofitting already developed areas and their existing stormwater facilities to that improve management of that water, 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 practices in this section to improve the Jordan River.

Consider the goals or management objectives you are trying to achieve:

There are five types of land management goals that the 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 and introduced 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. The more people use and value the Jordan River, the greater their connection and feeling of stewardship will be. 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 practice's, such as preservation of open space can greatly benefit the quality of stormwater discharges to the Jordan River by preventing initial impacts and providing natural measures to treat stormwater from up gradient. Nevertheless, stormwater best practice's currentlyBP's currentlyhave and will continue in the future, to provide that last defense and implementing them appropriately and timely will benefit the Jordan River.

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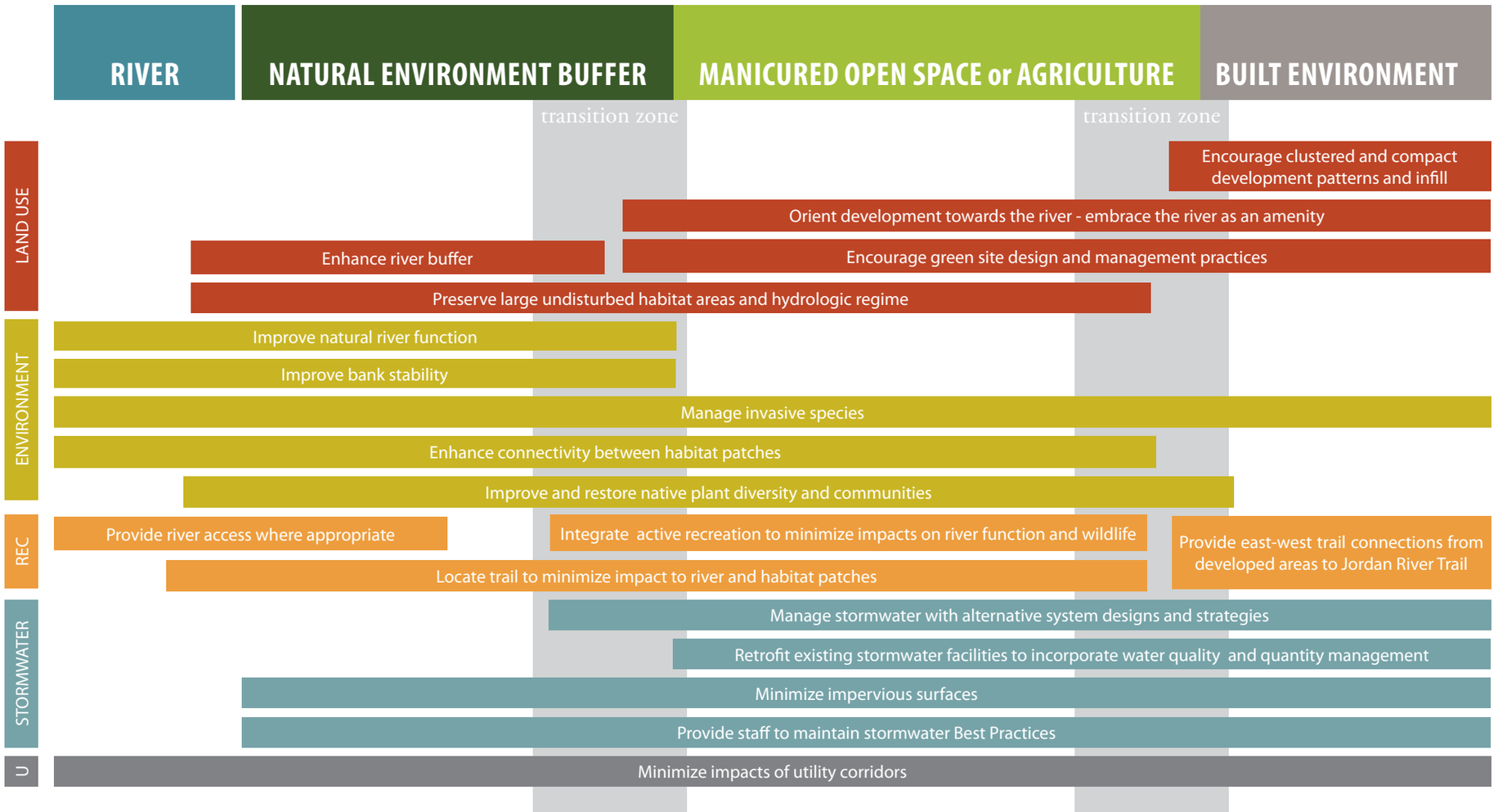
JORDAN RIVER CORRIDOR GRAPH and Best Practices



The goal is to create an integrated system of practices that work together.

LEGEND

- Landuse Best Practices
- Environment Best Practices
- Recreation Best Practices
- Stormwater Best Practices
- Utility Best Practices

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INTRODUCTION

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

WHO CAN USE THIS DOCUMENT?

Appointed and Elected Officials

A particularly strong responsibility lies with appointed and elected officials. 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 incentivize development through the planning process to return runoff to the ground in ways that mitigate the reduction in quality and quantity of stormwater. Elected officials have a significant influence on planning and zoning documents that are adopted by local communities.

Public Works, Planners, and Parks Departments

Departments can influence city and county policy by advancing information and potential direction to the administration and appointed and elected officials. This role is a general responsibility for all city and county departments, but the protection of the Jordan River can sometimes be negatively impacted 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, such as grass clippings, raked leaves or yard waste, in their gutter that eventually makes its way to the River. Landowners 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 use ofNon-profits can help preserve land and educate the community about River related issues. Farmer'sLand owners and land managers fertilization and pesticide for managing landscapes or agriculture may inadvertently pollute the River. 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.

Utilities and Canal Companies

Utility companies have multiple utility easements that cross the river and parallel the corridor. The utilities hold significant linear open space that requires access and to monitor for safety. Canal companies often return tail waters. Companies divert flows from the Jordan River and return water back to the river.

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, Utah Department of Transportation, Utah Transit Authority, 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 and trail connections to the River.

Other State and Federal Agencies

Many agencies are involved in the management and development oversight of land within 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 combat the degradation of the River.

INTRODUCTION

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

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.

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

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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 greatly 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 BMPs, 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 BMPs 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 BMPs and green infrastructure.

ADDRESSING CHALLENGES IN LAND USE REGULATION

Adopting new land use and zoning tools, however, involves challenges that are not typically associated with traditional BMPs. 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 (nonconformities), as well as special standards for infill and redevelopment. This final point is especially important given the extensive amount of current development within one half mile of the river.

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

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). 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.

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

BEST PRACTICES

- Enhance river buffer
- Protect large undisturbed areas and hydrologic regime
- Encourage clustered and compact development patterns
- Encourage green site design and management practices
- Ensure development is compatible with river environment

L LAND USE

ENHANCE RIVER BUFFER

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

ASSOCIATED BEST PRACTICES:

- E Improve and restore native plant diversity and wildlife habitat
- E Manage invasive species
- S Minimize impervious surface
- L Preserve large undisturbed habitat areas
- R Provide river access where appropriate

WHY IS THIS BEST PRACTICE IMPORTANT?

Important for protecting water quality, improving flood protection, and maintaining native vegetation along the river that supports aquatic and terrestrial species diversity. 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 rivershould 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 river
- Enhances water quality and fish habitat by filtering water of nutrients and pollutants and reducing sedimentation
- Increases wildlife habitat and migration routes along river corridor
- Increases bank stabilitiy
- 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

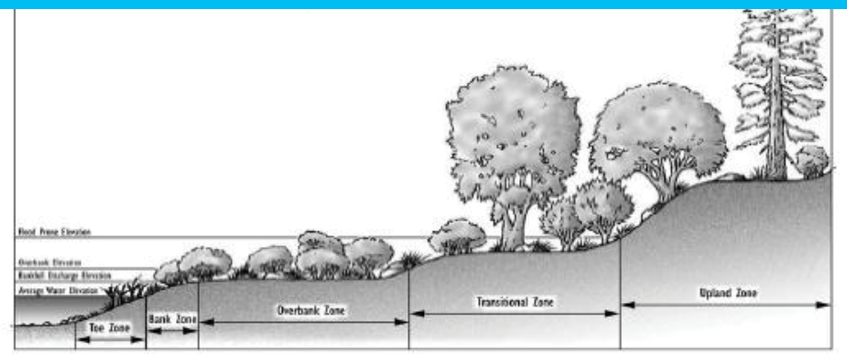

Figure 2: Riparian Planting Zones can be used to determine where riparian species should be planted in relation to the waterline. This is a general depiction of a riparian zone. Not all streams look like this one. In the real world, some of these zones may be absent. (From Hoag 2001, Hoag and Landis 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

RESOURCES

- Salt Lake City - Riparian Corridor Overlay District
- Boulder, CO, Planning Development Services, Wetlands and Stream Buffers: A Review of the Science and Regulatory Approaches to Protection

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PROTECT LARGE UNDISTURBED AREAS

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 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 wildfire habitat
- Provides recreation opportunities, such as birdwatching and exercise
- Provides flood control

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

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, 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 homeowner'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, C) (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:

- S Manage stormwater with alternative system designs and strategies
- E Improve and restore native plant diversity and wildlife habitat
- S Minimize impervious surfaces
- L Preserve large undisturbed habitat areas and hydrologic regimes

L LAND USE

ENCOURAGE CLUSTERED AND COMPACT DEVELOPMENT PATTERNS IN EXCHANGE FOR OPEN SPACE

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

ASSOCIATED BEST PRACTICES:

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

WHY IS THIS BEST PRACTICE IMPORTANT?

Clustering development preserves environmentally-sensitive land and open space by concentrating new development on less sensitive parts of a property. It also reduces sprawl by minimizing land consumed by roads, infrastructure, and structures.

DESCRIPTION

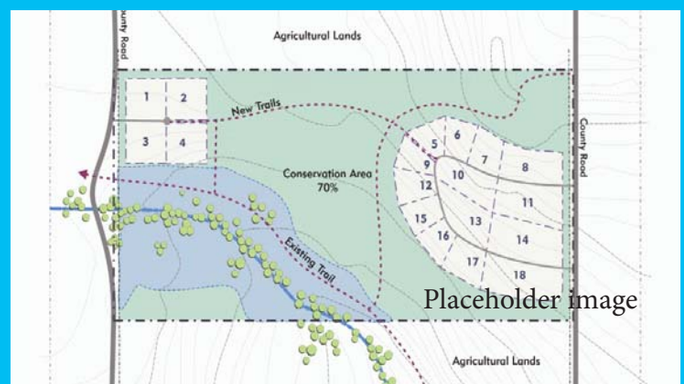
Clustered development tools are usually implemented through the subdivision process because this is the community's primary opportunity to impact the location and design of new development, such as the location, number, and layout of new lots. Whether clustered development tools are optional or mandatory the intent is to concentrate development away from protected sensitive areas (e.g., rivers, wildlife habitat, natural hazards, farmland) and locate it where it will consume the least amount of land. The undeveloped part of the property is usually permanently protected with an easement and may provide public access. It is often managed by a homeowner's association according to development approval conditions by the local government who would also have ultimate oversight responsibility as the beneficiary of the easement. In addition, minimum lot sizes are often reduced or waived to facilitate the clustering of lots, while density bonuses are sometimes used to encourage clustering or offset any potential loss in property value. In more complex programs, Transfer of Development (TDR) programs can be used to enhance the effectiveness of clustered development. In general, the goal is not to increase density but shift allowed density to areas that maximize public benefit by consuming less land with roads, sidewalks, driveways, and yards (with reduced irrigation needs) while preserving valuable open space. Clustering also significantly decreases infrastructure costs for the landowner in many cases.

BENEFIT

- Protects open space and wildlife habitat from urban sprawl
- 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

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



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.

CONSIDERATIONS

- Existence of vacant and developable land
- Long-term management of protected open-space areas
- Coordination with other local open-space and river protection-efforts, such as land trusts

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

JORDAN RIVER COMMISSION

JORDANRIVER
OUR RIVER ~ OUR FUTURE

ENCOURAGE GREEN SITE DESIGN AND MANAGEMENT PRACTICES

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, 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

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

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).

LONG-TERM MANAGEMENT

- Varies according to green design technique.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, OR (green roofs, rain gardens, pervious pavement, stream protection)
- Emeryville, CA (green infrastructure design guidelines)
- Lancaster, PA (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,

Local Project Success: ACG Building, West Valley City
Stormwater detention landscape
Photograph by Nancy Monteith

ASSOCIATED BEST PRACTICES:

- S Manage stormwater with alternative system designs and strategies
- E Improve and restore native plant diversity and wildlife habitat
- S Minimize impervious surface
- L Preserve large undisturbed habitat areas and hydrologic regimes

L LAND USE

ENSURE DEVELOPMENT IS COMPATIBLE WITH RIVER ENVIRONMENT

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. The river thus must not only be protected from physical degradation from development but 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 it 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.

ENSURE DEVELOPMENT IS COMPATIBLE WITH RIVER ENVIRONMENT

BENEFIT

- Improves aesthetics and creates a more natural character along river
- Increases awareness of 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

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.

CONSIDERATIONS

- Existing development patterns
- Redevelopment of incompatible uses

LONG-TERM MANAGEMENT

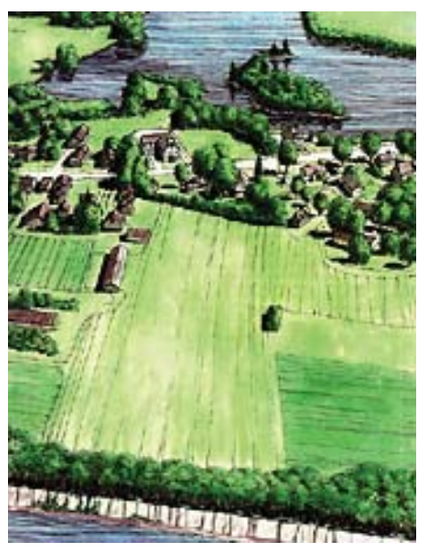
- Long-term governmental administration costs would be minimal.

RESOURCES

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

HOW TO

- Identify desired character for river corridor
- Develop architectural and site design standards to enhance desired character
- Encourage or limit incompatible land uses



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

ASSOCIATED BEST PRACTICES:

- S Manage stormwater with alternative system designs and strategies
- S Minimize impervious surfaces
- R Integrate active recreation to minimize impacts on river function and wildlife
- R Provide river access where appropriate

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PRESERVATION AND ENHANCEMENT OF THE JORDAN 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 US, 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 homogenous, 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 to30 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 to 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, objectives at both the species and community scale (i.e., species adapted to the area or in other words native species) must be considered in planning to restore the functions and values of the corridor. Increasing diversity requires coordination of conservation activities communities. Improving the corridor will require restoration of three ecological communities (i.e., aquatic, riparian and upland), thereby increasing habitat heterogeneity and encouraging native species to 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**

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

BEST MANAGEMENT PRACTICES

- Improve natural river function
- Improve bank stability
- Manage invasive species
- Enhance connectivity between habitat patches
- Improve and restore native plant diversity and communities

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

1. 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.

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 intermountain 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 that are tuned to natural growing seasons and are sensitive to patch shapes and dynamics. The advantage of more natural management methods can be a reduction in vegetation maintenance costs.

2. 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 landuse 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 (Bronze), 100 to 200 feet (Silver), and 200 to 300 feet (Gold) and would be expected to attract various bird species.

Given the difficulty of determining 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

- 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

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 low development along the Jordan River where the flood plain 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 requires 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

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 by,

- Discouraging development within the floodplain to allow for natural meandering of the river through it's corridor.
- Using 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 by,

- Restoring vertical river banks to a more gentle relief by reducing erosion and allowing natural movement and deposition of stream sediment.

CONSIDERATIONS

- Larger areas have the potential to support more native species
- Human access to established habitat areas

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

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. December 1992.

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

ASSOCIATED BEST PRACTICES:

- E Enhance connectivity between habitat patches
- L Protect habitat patches and hydrologic regime
- E Improve bank stability
- E Manage invasive species
- L Preserve large undisturbed habitat areas
- S Minimize impervious surfaces
- L Enhance River Buffer

E ENVIRONMENT

IMPROVE BANK STABILITY

Local Project Success: Walden Park (5400-5600 South)
Murray City, Utah
Photograph by Nancy Monteith

ASSOCIATED BEST PRACTICES:

- E Improve natural river function E
- E Manage invasive species E
- E Enhance connectivity between habitat patches E
- E Improve and restore native plant diversity and communities E
- L Enhance river buffer L
- L Preserve large undisturbed habitat areas and hydrologic regime L
- R Provide river access where appropriate

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 and riparian functions, such as habitat quality and effectiveness, 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
- Reestablished healthy riparian zone functions
- Reduced long-term maintenance costs and erosion problems associated with impervious structures
- Aesthetically appealing with a natural appearance

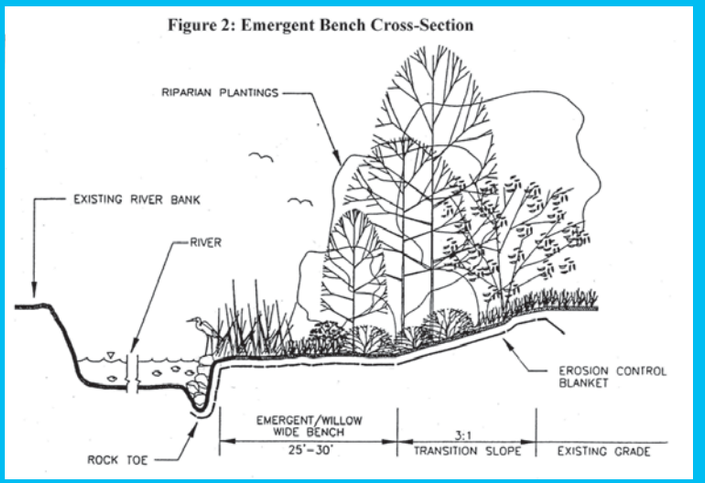
CONSIDERATIONS

- Reach-scale survey of river channel banks to determine bank conditions and appropriate biotechnical methods and placement.
- Site-specific characteristics (e.g., slope, location and bank stability requirements)
- County, city, U.S. Army Corps of Engineers, and sovereign lands permits required for most biotechnical slope stabilization projects within riparian corridors
- Density of planting according to slope steepness

HOW TO

- Conduct site-specific professional design
- Acquire state, city, and Salt Lake County Flood Control permits for biotechnical slope stabilization project
- Plan construction during low flow seasons (after peak runoff) or as conditions allow
- Use appropriate materials for toe protection, bank and slope zone

Figure 2: Emergent Bench Cross-Section



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

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

JORDAN RIVER COMMISSION

JORDANRIVER OUR RIVER - OUR FUTURE

MANAGE INVASIVE SPECIES

WHY IS THIS BEST PRACTICE IMPORTANT?

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

DESCRIPTION

Invasive species are plant and animal species that are 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 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(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 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, nutrient cycling
- Improved aesthetics for recreational user groups by restoring native wildlife to corridor

CONSIDERATIONS

- Restoration required post management and control to prevent re-establishment of invasive species
- Cumulative environmental impacts of management methods

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)
- Establish institutional controls that follow local ordinances to control invasive plant populations on private lands (to compliment state statues)

IMPLEMENTATION REQUIREMENTS AND COST

- Prevention most cost-effective approach
- Management costs reduction 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

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)

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

ASSOCIATED BEST PRACTICES:

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

E ENVIRONMENT

ENHANCE CONNECTIVITY BETWEEN HABITAT PATCHES

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

ASSOCIATED BEST PRACTICES:

- E Restoration of native plant diversity and wildlife habitat
- E Manage invasive species
- E Improve bank stability
- L Preserve large undisturbed habitat areas and hydrologic regime
- R Provide river access where appropriate

WHY IS THIS BEST PRACTICE IMPORTANT?

Important for maintaining species diversity and sustainability along the Jordan River corridor. 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

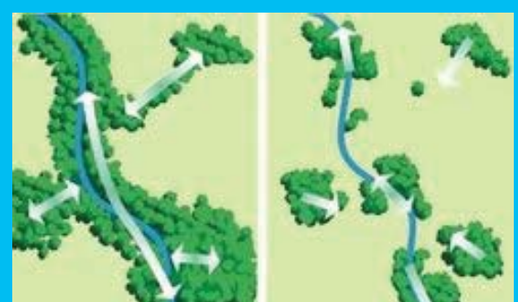
- Protection of native species from natural and man-made environmental disturbance
- Potential of increasing the extent of quality wildlife habitat along the river corridor
- Potential to connect habitat in river corridor to adjacent open spaces
- Improved water filtration, erosion and nitrogen deposition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

CONSIDERATIONS

- Existing man-made or natural barriers
- Umbrella species and habitat requirements

HOW TO

- Conduct site inventory of existing habitat condition and fragmentation
- Identify indicator species that maximize movement opportunities for a biological community
- Site preparation- removal of invasive plant and hardscape materials
- Installation of native vegetation mix that addresses short- and long-term functionality habitat goals
- Installation of alternative movement structures e.g., box culverts under river bridges
- Regular and adaptive watering during initial growing season (2-to-3-day cycle) and as needed
- Noxious weed control and management during initial growing season and over the long-term



http://www.smartgrowthvermont.org/toolbox/issues/wildlifecorridorprotection/

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

LONG-TERM MANAGEMENT

- Habitat maintenance
- Monitoring program of corridor connectivity effectiveness
- Monitoring and management of exotic and invasive 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

DRAFT

JORDAN RIVER COMMISSION

JORDANRIVER OUR RIVER - OUR FUTURE

RESTORE NATIVE PLANT DIVERSITY AND WILDLIFE HABITAT

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 initial weed removal and long-term weed management, as well as naturalized planting of native 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 river corridor for recreational user groups
- Reduced long-term maintenance costs (vegetation clearing and mowing)
- Increased wildlife viewing and bird watching potential (bronze, silver, and gold species)
- Recreational opportunities (e.g., nature walks)

CONSIDERATIONS

- Underlying causes of disturbance before revegetation is implemented
- Larger areas have the potential to support more native species
- Human access to established habitat areas

HOW TO

- Site inventory, design, and analysis
- Site preparation: removal of invasive plant species and hardscape materials, and prepare topsoil
- Planting of native 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
- Regular watering during initial growing season (2 – 3 day cycle) and site-specific management
- Noxious weed control during initial growing season

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 over the long-term
- Irrigation until plant establishment

RESOURCES

- Salt Lake County Natural Areas Land Management Plan Standards Manual, December 2007

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

ASSOCIATED BEST PRACTICES:

- E Connectivity between habitat patches
- E Manage invasive species
- E Improve bank stability
- L Preserve large undisturbed habitat areas
- R Provide river access where appropriate
- R Provide river access where appropriate

DRAFT

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RECREATION IS A COMPATIBLE USE AND BUILDS STEWARDSHIP

The Jordan River Corridor is a great recreation resource for the region. It provides the opportunity for people to experience a river environment in the midst of a heavily urbanized area. The Blueprint Jordan River demonstrated wide public support to maintain the corridor as a natural landscape, or "green corridor," and secondly a recreational space. The public's perception of naturalness is often less discriminating than that of an expert ecologist or scientist. Recreation opportunities can be created in areas that already have human influence, therefore meeting the expectations of experiencing a natural landscape while also protecting sensitive ecosystems and critical habitats. The Jordan River Trail has increased access and use for a variety of users, leading to increased knowledge of and engendering stewardship towards the Jordan River.

IMPORTANCE OF RECREATION

Best Practices for recreation include design of recreation features in a river-friendly manner and increased east-west access from the communities to the corridor. Salt Lake County residents just approved a bond measure to close the remaining trail gaps, which will result in a continuous trail from Utah Lake to the Great Salt Lake. Neighboring communities also desire more east-west connections to the Jordan River and regional transportation. Providing education and interpretive opportunities throughout the corridor will assist in developing an understanding of the importance of the Jordan River corridor for our region. As people use and gain greater understanding of the Jordan River corridor, they take more ownership to protect its resources. Implementing a unified system of interpretive, regulatory, and way-finding signage throughout the corridor will be important to cultivate appropriate use and community stewardship for all types of users.

The Jordan River is a valuable open-space and recreation resource for not only neighboring communities but the entire region. The parkway trail connects the numerous parks and golf courses located in and near the river corridor. Trail and recreation design should provide a variety of experiences from intimate, small-scale spaces to vast open spaces. Increasing connectivity to neighboring communities, regional transportation, and the canyons of the Wasatch Front increases the overall robustness and value of the network. Creeks that feed into the Jordan River are good corridors for recreation and access, but their habitats also need protection and enhancement.

Developing a water trail that allows the public to view the sensitive landscape with very little affect has tremendous opportunity. An important component to developing the water trail will be the identification of access points to the river that have minimal environmental impacts and are safe.

RECREATION AND SUSTAINABILITY OF THE ENVIRONMENT

Recreation and ecological sustainability is mutually beneficial. Recreation in the manicured open spaces should be integrated with green infrastructure and stormwater Best Practices. Native habitat patches can be incorporated into the manicured open space to enhance habitat connectivity and reduce overall maintenance. Incorporating river-friendly maintenance standards for both natural areas and manicured open spaces reduces negative impacts on the river. Providing education and interpretive facilities about these efforts will contribute to community sense of stewardship.

Open-space protection for recreation, as well as protection for sensitive lands, becomes more important as development pressures increase. Communities need ways to balance the value of the open-space versus economic development opportunities. A well-connected, open-space system that provides recreation as well as ecosystem services (e.g., flood control, clean water, clean air, and relief from the urban environment) has tremendous tangible and intangible value. The land use Best Practices work in conjunction with the recreation Best Practices to protect open space in perpetuity and can be facilitated by conservation easements and land trusts, Transfer of Development Rights (TDRs), and overlay districts.

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

BEST PRACTICES

- Provide river access where appropriate
- Locate trail to minimize impact to river and habitat patches
- Integrate active recreation to minimize impacts on river function and wildlife
- Provide east-west trail connections from developed areas to Jordan River Trail

R RECREATION

PROVIDE RIVER ACCESS WHERE APPROPRIATE

Local Project Success:

ASSOCIATED BEST PRACTICES:

- L Preserve large undisturbed habitat areas
- E Improve natural river functon
- E Enhance connectively between habitat patches
- E Manage invasive species
- R Locate trails to minimize impact to river and habitat patches
- S Minimize impervious surfaces

WHY IS THIS BEST PRACTICE IMPORTANT?

Providing visual and physical access to the river greatly contributes to the experience of corridor users. Safe and environmentally sustainable access to the river helps to protect the river and its habitat while providing a variety of recreational and educational experiences along the corridor.

DESCRIPTION

Bridges, boardwalks, and elevated walkways facilitate pedestrian access to the river and its adjacent sensitive environments. Planning and design of facilities that provide access to the river (e.g., bridges, boardwalks, 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 Parkway and are vital to providing access to the corridor from adjacent communities. The location and design of bridges can enhance or restrict recreation use and experiences and the corridor's safety and sustainability. Bridges are needed and desired for users of the Jordan River Trail to have easy access to desired areas without restricting access to the water trail and impacting riparian habitat. Bridges that are too low may cut off access by, or create dangerous obstacles for, water trail users. Bridge abutments too close to the river may be damaged by changes in water levels and bank erosions, leading to damage to the bridges or safety hazards.

Access to the water trail can be provided by a variety of boat launches, including natural shorelines, beaches and simple ramps, floating launches, pipe launches, cantilever launches, and concrete ramps. Development of river access facilities should consider the river's fluctuations over time. Ramps, stairs, and fishing piers that float, rather than being fixed, 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

CONSIDERATIONS

- Dvelop boat launches in appropriate locations near areas of parking
- Enhance regional connectivity and transportation opportunities

HOW TO

- Locate launches and bridges so they are easily visible from both the river and shore for water trail users
- Locate bridges frequently enough to provide access to the corridor from adjacent communities, but no so frequently as to affect riparian habitat and use by water trail users
- Do not locate facilities where there is exposure to strong currents and winds, where water users cannot avoid them, and where significant erosion is possible
- Carefully consider bridge design to maintain enough clearance for water trail users. Bridges are also a construction point and may cause flood control issues as well as prevent the river from being able to meander naturally
- Avoid sensitive environments and critical habitats
- Use boardwalks and elevated walkways where access is required in sensitive environments
- Develop access points and boat launches in areas that already have human impacts
- Install ramps, which have 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 launches
- Decommission launches located in low value areas or that are poorly designed

IMPLEMENTATION REQUIREMENTS AND COST

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

LONG-TERM MANAGEMENT

- On-going maintenance of recreation facilities and vegetation management

RESOURCES

- Minnestoa 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

LOCATE TRAILS TO PROTECT RIVER AND HABITAT

R RECREATION

WHY IS THIS BEST PRACTICE IMPORTANT?

The physical location of the trails in the Jordan River Corridor has important environmental impacts and implications for sustainability. Investing in trail improvements without considering FEMA's floodplain requirements could result in costly relocations or regulatory violation. Be familiar with local, state, and federal regulations along water bodies when locating a trail. Protecting natural habitat areas creates a higher quality nature experience for the trial user.

DESCRIPTION

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

New trail development should be located in areas that have already been influenced by human activity. Trails should be safe, convenient, and provide a high value experience while also contributing to a regional transportation network. The trail should be located to minimize impacts on the sensitive ecological areas and to protect large habitat patches. Trails should also avoid the transition zone between two or more habitat types, called ecotones, because these areas are often ecologically important. Rather than parallel edges, trails should cross ecotones in locations where impacts can be minimized. New river crossings should be carefully considered so they are kept to a minimum to protect the riparian habitat.

BENEFIT

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

CONSIDERATIONS

- Develop a hierarchy of trails to provide a variety of experiences
- Enhance regional connectivity and transportation opportunities
- Locate trails away from areas prone to flooding to prevent damage and to support year-round use

HOW TO

- Avoid locating trails in the river buffer zone so the river has room to meander and potential damage during floods is reduced
- Avoid sensitive environments and important wildlife habitat
- Develop trails in areas that already have human impacts
- Use natural infiltration and stormwater best practices
- 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
- Avoid locating trails in the transition area between two different plant communities
- Identify important view sheds to preserve and manage vegetation and to maintain visual access to the river

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

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
- Minnestoa 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 Preserve large undisturbed habitat areas
- E Improve natural river function
- E Enhance connectively between habitat patches
- E Manage invasive species
- R Provide river access where appropriate
- R Enhance east-west trail connections to communities and regional transportation
- S Minimize impervious surfaces

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R RECREATION

INTEGRATE ACTIVE RECREATION TO MINIMIZE IMPACTS ON RIVER FUNCTION AND WILDLIFE

Local Project Success: Murray Fish Pond
Photograph by Nancy Monteith

ASSOCIATED BEST PRACTICES:

- L Preserve large undisturbed habitat areas
- E Improve natural river function
- E Enhance connectively between habitat patches
- E Manage invasive species
- R Locate trails to minimize impact to river and habitat patches
- S Minimize impervious surfaces
- S Manage stormwater with alternative system designs and strategies

WHY IS THIS BEST PRACTICE IMPORTANT?

Active recreation areas in manicured open spaces serve important recreational and ecological functions, but with design and planning they can do more. By integrating these spaces into the infrastructure network, they can clean urban runoff, infiltrate rainwater, and provide space for flood waters while providing opportunities for recreation, contact with nature, and beautiful landscapes.

DESCRIPTION

Large open spaces for sports fields, open play, and golf can also be designed to manage stormwater, enhance groundwater recharge, reduce urban heat island, and 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 to improve wildlife corridors and contribute to the sense of place. Green infrastructure is the integration of natural systems and engineered solutions to create landscapes that not only provide healthy habitat but also cleaner water and air and overall quality of life. High quality natural areas increase nearby property values and natural systems that restore hydrological balance and reduce a community's dependence on costly engineered systems.
While large open spaces for sports fields, open play, and golf can minimize impacts on river function and wildlife, traditional maintenance practices for these facilities may negatively affect the river. The extensive use of fertilizers and pesticides can run off into the river, damaging water quality. Minimizing the use of fertilizers and pesticides in open space areas, designing open turf areas to avoid drainage into the river, and creating more naturalized parks and open spaces where the need for conventional practices (e.g., mowing, pruning, fertilizing and pesticide use) is minimized will further reduce contaminants from entering the Jordan River.

BENEFIT

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

HOW TO

For new parks and recreation facilities:

- Locate park land between developed areas and the river
- Design with natural processes and make them visible
- Use open areas and athletic fields as stormwater detention areas, while maintaining the field quality and playability
- Avoid draining turf areas into the river and provide a berm or swale to capture runoff from turf areas where fertilizers are used
- Protect as much native cover and sensitive areas as feasible. Enhance native areas with additional patches of native vegetation
- Reduce manicured turf to a functional minimum
- Use turf grasses that require minimal mowing, pruning, and fertilizing for the proposed use
- Reduce pavement and make surfaces permeable

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 bio-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 plan to reduce use and dependence on pesticides
- Train staff in sustainable management practices and recognize employees for achieving sustainability goals

IMPLEMENTATION REQUIREMENTS AND COST

- Lower lifetime costs
- Reduced offsite costs
- Functional use of open space land

LONG-TERM MANAGEMENT

- Management of invasive species
- Management of storm water facilities

RESOURCES

- Salt Lake County Watershed Stewardship Plan
- Minnestoa 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

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ENHANCE EAST-WEST TRAIL CONNECTIONS TO THE JORDAN RIVER TRAIL AND REGIONAL TRANSPORTATION

R RECREATION

WHY IS THIS BEST PRACTICE IMPORTANT?

The Jordan River Trail is a regional recreation facility as well as 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 alternative transportation and makes the corridor accessible to more people.

DESCRIPTION

Communities have voiced avid appreciation of the Jordan River Trail and desire 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 to regional transportation nodes further reduces the need for parking in proximity to the Jordan River Corridor. The linking of trail systems on both local and regional levels is important to create a robust and comprehensive trail system.

BENEFIT

- Active transportation encouraged
- Enhanced recreation access for a diverse user group
- Reduced need for parking in near proximity to the Jordan River
- Increased active transportation connectivity and reduces dependence on the automobile

CONSIDERATIONS

- Develop a hierarchy of trails to provide a variety of experiences
- Enhance a regional connectivity and transportation opportunites

IMPLEMENTATION REQUIREMENTS AND COST

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

HOW TO

- Involve community stakeholders in the trail planning process
- Incorporate fully functional 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
- Incorporate regionally standardized way-finding, regulatory, and interpretive signage
- Avoid sensitive environments and critical habitats
- Develop trails in areas that already have human impacts

LONG-TERM MANAGEMENT

- On-going stewardship of trail and adjacent natural system
- 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

Local Project Success:

ASSOCIATED BEST PRACTICES:

- L Preserve large undisturbed habitat areas
- L Clustered development
- E Manage invasive species
- R Integrate active recreation to minimize impacts on river function and wildlife
- S Minimize impervious surfaces

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ROLE OF STORMWATER IN JORDAN RIVER WATER QUALITY

Stormwater from most of the urban areas in the greater Salt Lake valley, flow 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. There are many best practices available to municipalities that can be incorporated into storm drain systems and site development. 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, 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. 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 nonpoint 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.

S STORMWATER

Local Project Success:
UTA's Mid-Jordan Light Rail Project wetland mitigation site
Murray, 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 Management Practices

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S STORMWATER

MANAGE STORMWATER WITH ALTERNATIVE SYSTEM DESIGNS AND STRATEGIES

Local Project Success:Jordan RIver Migratory Bird Reserve Wetland Habitat
Photograph by: Eric McCulley

WHY IS THIS BEST PRACTICE IMPORTANT?

These practices reduce volume of stormwater as well as reduce sediment, heavy metals, oils and grease, and other floatable 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.

BENEFIT

- Removal of sediments containing organic matter, non-soluble metals
- Removal of oils and grease
- Removal other floatable 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

CONSIDERATIONS

- 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.

RESOURCES

- Salt Lake County Stormwater Best Management Practices
- EPA BMP Database and Water Quality Scorecard

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 best practicess 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
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 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 provide stormwater detention. Both types of detention treat for sediment, but wet detention treats for nutrients and organic material better than dry.

ASSOCIATED BEST PRACTICES:

L Cluster development
R Minimize impacts of active recreation on habitat
E Manage invasive species
S Minimize impervious surfaces

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RETROFIT EXISTING STORMWATER FACILITIES TO INCORPORATE WATER QUALITY MANAGEMENT

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 development that documents maintenance activities

BENEFIT

- Removal of sediments
- Removal of oils and grease
- Removal other floatable 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
- Remove sediment from storage basin
- Repair erosion
- Water circulation for water quality

RESOURCES

- Salt Lake County Watershed Stewardship Plan
- SL 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 (see below) 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 soluable 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 systems and designs
- S Minimize impervious surfaces

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MINIMIZE IMPERVIOUS SURFACES

Local Project Success: ACG Building, West Valley City
Photograph by Nancy Monteith

ASSOCIATED BEST PRACTICES:

- L Cluster development
- R Minimize impacts of active recreation on habitat
- E Manage invasive species
- S Minimize impervious surfaces

WHY IS THIS BEST PRACTICE IMPORTANT?

Minimizing impervious surfaces reduces sediment, heavy metals, oils and grease, and other floatable 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 volume of stomwater 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 floatable materials
- Reduction in downstream erosion potential

HOW TO

IMPLEMENTATION REQUIREMENTS AND COST

- Capital cost medium
- Operation and maintenance costs medium

CONSIDERATIONS

- Curbing requirements are reduced or eliminated for low impact storm drainage developments.

LONG-TERM MANAGEMENT

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

RESOURCES

- Salt Lake County Storm Water Guidance
- Sustainable Sites Handbook
- Salt Lake Countywide Water Quality Stewardship Plan, 2009

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STORMWATER MAINTENANCE

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 styems 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

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.

LONG-TERM MANAGEMENT

- The purpose is to provide long-term management of BPs.

LOCAL EXAMPLES

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

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

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MINIMIZE IMPACTS OF UTILITY CORRIDORS

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, updates 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.
Mitigation of new facilities and improvements to existing facilities should be considered in the planning and design phase, as well as in consider 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

- New facilities or upgrading of existing facilities
- Existing facilities
- Planning and design in vicinity of existing facilities
- Natural river flow and habitat development

HOW TO

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.
- 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

- 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.

IMPLEMENTATION REQUIREMENTS AND COST

- Variable

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

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:

- E Connectivity between habitat patches
- E Manage invasive species
- L Preserve large undisturbed habitat areas
- S Minimize impervious surfaces
- L Enhance River Buffer

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ANNOTATED OUTLINE OF RIPARIAN PROTECTION ORDINANCE

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.

> "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:
>
> 1. Protect the valuable, limited and endangered natural riparian habitat resources of the Town;
> 2. Provide an ecologically sound transition between riparian habitat communities and developed/developing areas;
> 3. Assure the continuation of existing or natural functions, values and benefits provided by riparian habitat resources;
> 4. Protect aesthetic and environmental values of riparian habitats for the enjoyment of residents and visitors; and,
> 5. Maintain linear continuity for riparian habitat." (Oro Valley, AZ)

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, OR)

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, AZ)

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, WY)

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

ANNOTATED OUTLINE OF RIPARIAN PROTECTION ORDINANCE

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, UT)

"…. 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, WY)

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, OR)

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, UT)

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, UT)

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:

i. 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, OR)

i. Native vegetation protection and weed control;

"All landscaping must comply with the native plant requirement of the Willamette Greenway Plan." (Portland, OR)
"Development shall be sited and designed to protect native grassland areas." (Santa Barbara

County, CA)

ii. Reduction or limitation on impervious surfaces;

Parking may not exceed 120% of the required permitted parking. (Example)

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

iii. 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, CA)

iv. 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, OR)

i. 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, WA)

ii. Fencing;

"Fencing shall comply with Section 49220, Wildlife Friendly Fencing." (Teton County, WY)

iii. 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, AZ)

iv. 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, WY)

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, AZ)

"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, OR)

8. 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."

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."

8. Enforcement

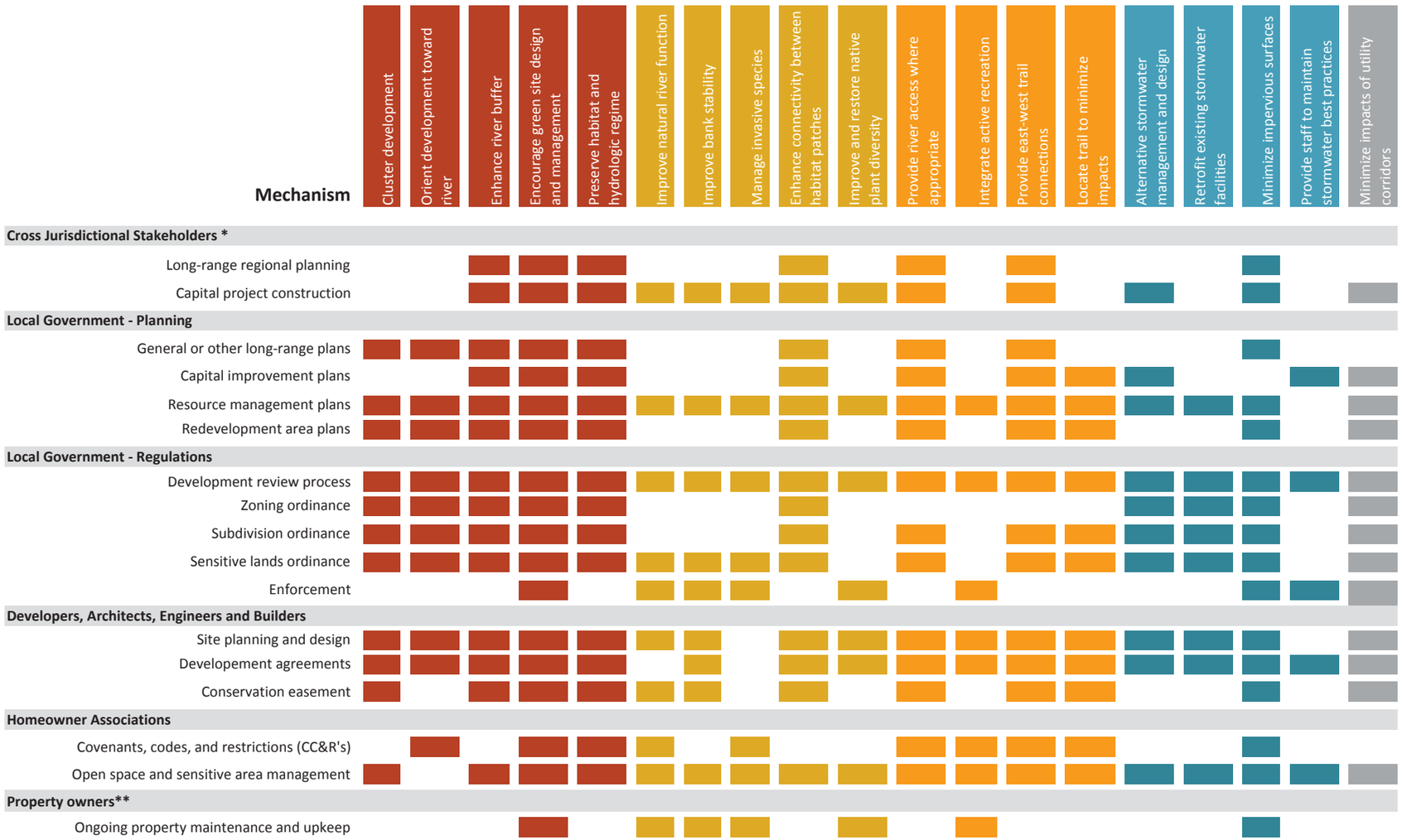
This section should identify who is responsible for enforcing the riparian ordinance, what constitutes a violation of the ordinance, and the penalties and enforcement measures available in case of violations. If there are no special enforcement provisions that are unique to the riparian ordinance, then 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.

HOW TO INCORPORATE JORDAN RIVER BEST PRACTICES

TOOLS



* Cross Jurisdictional Stakeholders includes Federal Agencies, Transportation Agencies, MPO's, and utility companies

** Property owners includes private (residential, commercial, and agricultural), cities, counties, State, Federal, utility companies, canal companies, non-profits

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GLOSSARY

Brush layering	A revegetation technique that combines layers of dormant or rooted cuttings with soil to stabilize streambanks and slopes.
Habitat connectivity	Describes the degree to which the landscape facilitates animal movement and other ecological flows.
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.
Habitat	The area or environment where an organism or ecological community normally lives or occurs.
Habitat Patch	An area of distinct habitat type separated from other areas of suitable habitat by areas of non-usable habitat.
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 s pecies
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.
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.
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.
Macroinvertebrate	Organisms without backbones, which are visible to the naked eye.
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.
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.
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.

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