

# INTEGRATING URBAN DESIGN FOR CREEK RESTORATION PROJECTS

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## ABSTRACT

Creek restoration in highly urbanized settings offer unique opportunities to enrich the community in decaying brownfield areas. These projects can enhance a sense of identity through the creation of a cultural system which results in a landmark focal point, illustrating that flood control does not have to be ugly. Historically successful urban creek restoration projects which have integrated urban design elements have resulted in “river walk” type features which can enhance the quality of life and human activity, as well as environmental enhancement. Urban redevelopment projects often include existing flood control facilities or flood protection requirements which typically manifest as physical constraints rather than approached as opportunities. Introduction of the **urban design** element as part of the flood control planning assists in developing a vision for the project which integrates the adjacent redevelopment areas that will result in bringing vitality and grace to the community. Creek restoration through urban centers requires a flexible design program resulting from a collaboration of river engineering, hydraulics, urban design, environmental and ecology, landscape and bioengineering, and business development which allows collective solutions. Urban design allows water to serve as a common thread that links the project’s spaces together. Important issues which need to be addressed in the planning process includes (1) transportation, (2) landscape restoration, (3) ecosystem benefits, (4) historical landscape and native feature preservation, and (5) recreational design elements. The driving concern in the majority of urban redevelopment projects is restoring the economic growth and vitality of the community. The “river walk” feature provides a vehicle to attract the general public to this area and ensure the economic success of the project. A case study is reviewed which applied urban design planning for a commercial redevelopment project in the City of Vista, California involving the replacement of a 1950 concrete flood control channel into a restored natural “river walk” linear park. The proposed creek restoration would provide the focal point for an economic revitalization of the downtown area that includes restaurants, shops, and entertainment center, with the creek providing the common linkage.

## **INTRODUCTION AND BACKGROUND**

Urban brownfields often plague major cities which have experienced loss of industries and commercial development, resulting in environmental burdens to the community which include vacant, derelict, or abandoned sites. A common byproduct of decaying urban development area is the public infrastructure in these areas which includes regional drainage facilities, in the form of degraded creeks, dilapidated riverfronts, polluted waterways, and concreted flood control channels. Residents of established communities in these highly urbanized centers have little opportunity to enjoy benefits associated with natural waterways, and are generally restricted access to these single-use urban rivers in a concrete jungle setting that provide no recreation opportunities or open space potential. Often times engineered turn-of-the-century flood control facilities create physical barriers within the community and have little functional relationship with the adjacent surrounding urban landuses. These urban rivers/creeks have become little more than open sewers for urban runoff and neighborhood waste receptacles, lottering locations for youth gangs and graffiti. However, a current trend by civic leaders and urban planners is that they have recognized that without reclaiming these waterways and improving adjacent urban neighborhoods, many communities will continue to bear the burden of the environmental sins of the past. A common solution which has evolved is new parks and public open space that can be the catalyst for revitalization of the downtown urban areas.

A more holistic and inclusive approach is necessary to develop a successful restoration program of urban rivers which ensures the maximum benefit to the community. This approach generally involves a collaboration between the public and private sector, and consultants of various disciplines to solve both technical and political problems associated with such a complex project. Multi-objective flood control projects are common place, but the majority of these only focus on satisfying specific internal objectives and are not aware of the project inter-relationship with the surrounding neighborhood or community. Creek restoration typically has involved environmental restoration of riparian corridors with passive public use and providing limited access to the community. However, within densely populated urban centers this primarily single function restoration program may have limited environmental benefits and may have difficulty in obtaining funding. A program which focuses on integrating urban design elements can integrate environmental, as well as, economic benefits for the community that may assist in funding the program by attracting private investment. Engineering improvements to the enhance or modify the existing urban rivers infrastructure can be designed as an integral part of the surrounding community which allow inherent landscape and design features to satisfy a multitude goals, including providing a showcase to preserve rich history of the community.

Effective flood control of urban rivers is an underlying primary objective to ensure public safety, however, non-conventional techniques which incorporate urban design will result in project which there are more opportunities for the public and benefits to the community. Urban watersheds generate significant quantities of runoff associated within rainfall events over a short period of time and require adequate means of hydraulic conveyance. Limited space is generally available in these built-up urban areas which restricts the available channel cross section and increases the flow velocity. Channel hydraulic characteristics then become a key design factor which

will dictate the potential alternative solutions or ability to modify the existing flood control infrastructure. Once the flood protection solution has been achieved, then the other urban design amenities can be introduced to the project.

## **SUCCESSFUL URBAN CREEK RESTORATION PROJECTS**

Examples of the successful application of urban creek restoration which integrated urban design and provided revitalization to the community are not exclusive to a particular region, but can be found throughout the nation. Selected examples of a few representative projects are provided below:

- **San Antonio River Walk (San Antonio, Texas)** - Stretching along a 2.5 mile portion of the San Antonio River is the Paseo del Rio or River Walk is a landscaped corridor as it winds through the downtown district and lined with European-style sidewalk cafes, specialty shops, galleries, nightclubs, and high-rise hotels. The River Walk is neither pure park or pure business core, but represents a special blend of these two elements that supports a wealth of diverse activities. The lure of interesting shops and places of entertainment is as important as the atmosphere and beauty of the botanical garden.
- **Historic Arkansas River Walk (Pueblo, Colorado)** - Focus on returning the Arkansas River to its historic channel through downtown Pueblo which will integrate trails, sidewalk cafes, retail development opportunities, along with public spaces for art and entertainment including reestablishing the connection of City Hall and the River.
- **Guadalupe Riverfront (San Jose, California)** - A major floodplain open space corridor through the central downtown area which was originally designed by the Army Corps of Engineers to be an engineered lined flood control facility to satisfy the flood protection requirements. The local community redesigned the \$138 million river project with a more natural setting and park-like amenities which would attract the general public.
- **New River Walk Park (Fort Lauderdale, Florida)** - Multi-million dollar waterfront redevelopment project through downtown Fort Lauderdale which provides linkage between cultural and historical centers of the community
- **Tennessee Riverpark (Chattanooga, Tennessee)** - Tennessee Riverpark Master Plan provided for revitalization of Chattanooga's Riverfront of former industrial sites, vacant or unused property along a 22-mile stretch of the Tennessee River. Representing an investment from 1987 to 1995 of \$33 million, the Riverpark provides the setting for recreation and entertainment, and has encouraged more than \$200 million of investment in properties along the River Walk by private business.
- **Downtown Creek Front - Cherry Creek (Denver, Colorado)** - This creek revitalization project links college campus to downtown, provides water oriented open space lined with parks and infill commercial development, greatly improving pedestrian links between the downtown's cultural and shopping districts.

Perhaps the most widely recognized downtown river walk revitalization project is the San Antonio River Walk. So successful is this particular River Walk that it has been widely studied and imitated as a model for urban redevelopment around the world. The uniqueness of this river walk is that it provides a pleasant balance of park-like setting and commercialism so that the tourist and the local citizen have a delightful special place for relaxation and relief from the congestion of the city core. Other elements which make the San Antonio River Walk successful include: (1) diversity of activities that is not typical of the usual city park, (2) dominant environmental and Spanish-American theme consistent with preserving or highlighting the historical elements of the city, (3) strong community support of the civic amenities, and (4) successful joint effort cooperating with government and private interests for planning and management of the River Walk. However, many communities have had difficulties in implementing similar programs for the redevelopment of their waterways or riverfronts. Some of the specific reasons that these restoration programs have not been successful include the following:

- Lack of flood control
- Over-engineered channelization which limits a park-like waterfront setting
- Lack of support from downtown business interests
- Lack of public understanding of landscape and planning proposals
- Over-protective environmental constraints and regulatory requirements
- Narrow and poorly conceived plans
- Lack of financial support
- Lack of leadership and organized effort

These items should be considered when contemplating community revitalization development which involves an urban river and initially outline an effective program to overcome these obstacles or project constraints.

### **URBAN DESIGN - WHAT IS IT?**

Successful urban design links people to each other and their physical surroundings through influencing the physical fabric of the urban setting so that design objectives are realized collectively. The practice of urban design focuses on creative efforts targeting community spaces, such as public street, parks, and transportation systems, that form the underlying urban environment and develop the basis for the collective experience of the city. Urban design ensures that riverfront areas of urban rivers can achieve their maximum utility to the community and access for the public with the surrounding uses. It is through effective urban design that will shape the future form of communities into a cohesive array, which allows the urban river to effectively function as an integrated whole with neighborhoods, commercial areas, and public amenities. Another role of urban design is to preserve and create an urban character which is specific to a particular community which may include the historical or natural resources. Urban revitalization programs must incorporate historical and cultural resources as essential components in defining the unique character of the community.

These elements are prominent features in urban river revitalization programs which often become the theme of these developments. The river walk will often link adjacent historic project features and provide opportunities to promote unique cultural events as a part of these features.

Integrating urban design into river restoration process adds flexibility and detailed enhancements which provide the connection between culture and the environment. In addition, it ensures that urban redevelopment programs are compatible with responsible management of water-related public assets embodied in urban rivers. Pure engineered solutions ignore the importance of these design influences which generally results in a facility having limited secondary benefit to the community. However, through manipulation and amplification of physical features, natural materials, topography, and landscaping can provide an interaction or connection between the natural river system and the adjacent urban setting. Integrating a restoration program with urban redevelopment allows transforming derelict riverfront land into a greenway creating a more liveable city. This is significantly different than simply creating an environmental restoration of a degraded river habitat and provides more real impact on people and the community.

#### **DEFINING RESTORATION PROJECT OBJECTIVES**

Defining a “vision” for the project is critical input in the initial planning process which will assist in ensuring that the original community objectives are embodied into plan development. The vision becomes a functional framework to guide the plan formulation and implementation of the design features. The project vision statement integrates the community’s needs as well as the project’s practical and aesthetic objectives with a site’s opportunities and limitations. Common project objectives associated similar river walk redevelopment projects include the following which reflect the community vision of the project:

- Broaden range of visitor activities
- Provide enhanced recreation opportunities for residents
- Pedestrian link residential neighborhoods to downtown community areas
- Open restrictive portions of the stream
- Allow recreation activities that focus on the creek
- Provide water oriented activities
- Flood hazard mitigation
- Re-establishment of native plant communities
- Creek as amenity and focus for leisure activities
- Provides much needed open space in densely developed area
- Catalyst for outdoor activity, commercial, civic, and cultural activities
- Environmentally sustainable project and built to last
- Public spaces for art and entertainment
- Opportunities for the public to interact with the creek
- Central gathering places for cultural events

- Encourage pedestrian circulation
- Create visual interest of the entry and access points to the creek
- Incorporate unique climatic and geographic features of the area
- Natural interface or buffer between urban landuses
- Open space a catalyst for revitalization of downtown urban areas
- Visual and physical enhancement of the community's relationship to the river
- Preservation and celebration of heritage and local history

## **URBAN CREEK REVITALIZATION PLANNING PROCESS**

The complex nature of urban creek restoration necessitates initially developing a design program based upon a partnership between public and private stakeholders, that includes businesses and residents, and a collaboration between consultants of various disciplines. Plan formulation through this collaborative effort allows the collective group of individual experts (hydraulic engineers, landscape architects, traffic engineers, biologists, urban designers, city planners, and community leaders) to solve technical and political problems as a team. Another critical component required to initiate the planning program is the ability to articulate the community's vision of the creek restoration program, since this will provide the framework for the plan formation and ensure that the design features address these objectives. This process generally involves identifying primary issues and the design objectives which lead to conceptualization of an idea generating concept.

Utilizing a flexible design strategy which initially focuses on the general principles or components, rather than specific design features, allows freedom for the project to address input from various disciplines and evolve its unique characteristics. Addressing the primary underlying design principles simultaneously such as channel hydraulics, landscape design, circulation, site planning, and recreational elements will define the appropriate design criteria and allow integration of these components to form the basic design framework. A useful tool in this process is conducting "design charrettes" sessions with the team and stakeholders that provides a opportunity for creative input and project evolution. The result is that many of the project features can be designed to serve several functions, allowing many engineered components to be hidden through landscape or visual amenities.

Each of the technical disciplines needs to independently develop specific design envelopes of criteria that defines a range of boundary limits to allow design flexibility. An important initial design parameter is that the hydraulic engineer needs to provide a design envelope for the channel cross section geometry that indicates a general range of dimensions for the stream corridor, illustrating maximum and minimums. It is desirable that the design envelope for the channel provide the required flood protection and channel stability, but can still sustain the landscape elements and water elements during non-flood periods. As the restoration design evolves and plan takes a recognizable form, then continuous review of the added features is necessary by the individual disciplines through updating the appropriate technical analysis to ensure

design compatibility . Computer visualizations and renderings is another useful tool which provides an efficient method to translate the design into an image that communicates the design more effectively and often times graphically depicts relationships which were not readily apparent.. The overall process is dynamic with the many design details constantly changing, but the major design concepts will generally be maintained.

#### **ENGINEERING DESIGN ASPECTS**

The primary technical engineering aspect of the river restoration process involves the river hydraulics, although other engineering disciplines are inherently involved in the design process. Satisfying the hydraulic requirements associated with the river corridor design must focus on channel stability, sediment transport, flow depths and durations, and channel morphology. The river hydraulics provide a road map to the interaction or cause-and-effect of the other design features suggested by the various disciplines for inclusion to the river corridor program.

Hydraulic Design - Development of a comprehensive baseline analysis of the flood plain hydraulics is essential to understanding the operation, mechanics, and function of the river corridor. Hydraulic characteristics must be correctly identified to establish a relationship with the other design disciplines and planned features. An overriding concern of the hydraulic design is to satisfy the required flood protection.

Stream Morphology - Focus on the natural forms, tendencies, and characteristics of the river geometry. Recreating these landforms with the channel geometry increase long-term stability and opportunity for successful establishment of riverine landscaping. These elements also include the natural river sequence of riffles and pools

Channel Stability- Long-term stability of the streambed and channel banks is important to minimize the effect of erosion/degradation or deposition of sediment. Ability to ensure the survival of river corridor vegetation and preservation of any structural features addresses long-term economic considerations.

#### **COMMON DESIGN FEATURES**

Pedestrian Linkage and Public Accessibility - Encourage pedestrian circulation and to provide public access to the stream corridor along with linkage to other community transportation networks, including bicycle paths or public transportation. Trailheads to link neighborhoods and parking area or streets to the river greenway.

Recreational Elements - Provide a focal point for leisure activities which allow both passive and active uses that can include linear parks, open spaces, and trail systems.

Design Materials - Construction materials should be consistent with maintaining the project vision through architectural standards, typically resulting in the use native materials or attempting to recreate historical elements. The material selection involves careful planning since this results in a critical visible aspect which the public will associate the project.

Planned Public Spaces- Provisions to allow adequate planned space for designated public activities or to promote specific cultural events. Public spaces can include

locations for informal gatherings, public buildings, plazas, interpretative centers, opportunities for outdoor public activities, resting areas or public seating. These designed spaces assist creating a destination within the river walk, drawing the public into the river corridor from the adjacent urban uses while allowing them to spend time in the river walk.

Viewscapes - Dedicated locations to allow the public opportunities to share in the visual amenity of the river walk and accentuate the significant viewscapes of the river corridor which will identify the project..

Natural River Features - Preservation or the creation of the natural stream geomorphology includes specific features to ensure that the actual water flow visually recreates or mimics natural stream behavior. Establishing the natural channel geometry relationships becomes the aquascape design of the river corridor which includes the use of riffles and pools, along with the treatment of the stream edge.

Plantings - The proposed vegetation must be able to withstand the range of conditions within the river corridor since it is an active floodplain, as well as creating a natural composition which reflects similar native settings. Proper selection of the plant materials include both function as well as aesthetics.

Water Features - Water serves as the common thread which links the project features and provides . Additional water features such as fountains, The ability to deliver sustained year round flow in the creek is a design issue in semi-arid locations where only seasonal flows naturally occur

Park Amenities - Linear parks or greenways have the ability to serve more of the public with multiple uses, while having relatively low construction and maintenance costs compared to the big urban parks. The park features also create an atmosphere which provides a buffer to the adjacent urban uses. The amenities allow many public activities consistent with the park use.

Commercial Development - Integrating opportunities for commercial development along the river corridor introduces private investment and encourages the economic revitalization, providing a potential mechanism or nexus to assist in the financing.

Preservation of Historic Elements - Recreate historical landscapes which lend a sense of history to the project and can link adjacent historical landmarks into the theme.

Visual Amenities - Provide a sense of community identity through providing more visually attractive public spaces while providing the opportunity for the public to understand the underlying history and culture unique. Common elements which can personify the project features creating visual interest include interpretive or directional signage, kiosk, monuments, sculptures or art, and the recreating local historic elements.

#### **DESIGN APPLICATION: VISTA VILLAGE CREEK WALK PROJECT (VISTA, CALIF.)**

The City of Vista is a small community located in northern San Diego County which had historic agriculture beginnings, but is now one of the fastest growing towns in San Diego. An ambitious redevelopment program has been pioneered by the city which encompasses approximately 50 acres of decaying commercial and industrial parcels adjacent to the main street downtown area. The Vista Village Project includes



the development of a destination commercial / entertainment center with shops, restaurants, and theaters, along with a regional transit center. The jewel in the crown for the downtown redevelopment project is the **Creek Walk**, traversing through the spine of the project it replaces a 1951 SCS concrete flood control channel, and also incorporated preservation of a historic adobe building. Approximately 500 lineal feet of the existing concrete trapezoidal channel will be removed to develop a natural river corridor setting that will form the Creek Walk feature. This project represents part of the community strategy for economic revitalization of the downtown area to attract both residents and tourists, while providing a new unique civic symbol and source of pride.



## **ISSUES AND CONSTRAINTS**

Numerous physical constraints were associated with the project site which required unique design solutions from the collaborative team of various disciplines that were integrated into the Creek Walk and the plan formulation for the redevelopment area. Some of the critical design issues which were considered included: (1) existing hydraulic constraints and conveyance limitations, (2) existing flood control channel facilities, (3) published flood hazard zone encompassing the entire site, (4) existing commercial facilities to remain (water park), (5) preserving a historical adobe building, (6) existing fiber optics and other utilities, (7) seasonal water flow in the creek, (8) impaired creek surface water quality, (9) toxic groundwater associated with previous commercial uses at the site, (10) arterial roadway realignment and creek crossings, (11) handicap access, (12) space limitations, and (13) proposed adjacent commercial use requirements. Flood protection and the floodplain hydraulics became one of the primary driving design issues which must be resolved for the redevelopment area since the entire project is located within a mapped flood hazard zone from a watershed with a tributary drainage area of over 9 square miles. Creative hydraulic solutions were necessary in order to contain regional shallow overflow flooding from upstream sources beyond the project and to incorporate the natural riverine feature between two sections of engineered concrete channel.

## **CREEK RESTORATION PLAN AND UNIQUE ELEMENTS**

Pedestrian Walkways and Linkage - Numerous recreational features were incorporated into the Creek Walk plan which provided hidden design benefits and opportunities. Pedestrian paths were strategically planned to allow circulation through the stream

corridor or along both the upper banks through the overlooking restaurants and public spaces. Design criteria for the trail geometry criteria was dominated in part by the requirement for handicap access into the creek along with landscaped view corridor. Creek Section Geometry - The available space for the creek cross section was limited by the proposed commercial development requirements along the channel banks. The resulting cross section is of variable width and required numerous architecturally treated walls to maximize the available cross sectional area in the creek while incorporating all the additional urban design features. An artificial streambed defined the normal operating water levels, while the adjacent walkways and landscape vegetation was located at different levels within the creek section. The creek was divided into two primary areas which included (1) a an area devoted to a more natural river landscape, and (2) areas which provided a more park-like landscape experience that encourages the public to participate.

Amphitheater - A central feature is an amphitheater incorporated into opposing banks of the channel cross section which was designed as a public place to hold festivals and cultural activities. Strategically located within the mid portion of the stream corridor it provides a link to draw pedestrian traffic from one commercial center to the other end of the project.

Access Points - Public access to the creek was provided through a variety of locations to enhance the Creek Walk experience, providing opportunities to explore

Adjacent Commercial Activities - Several locations for restaurants along the edge of the river corridor have been provided capitalize on this feature and enhance its use.

Construction Materials - A variety of construction will be utilized which follows architectural standards specifically adopted for the redevelopment area that seek to preserve the enhance the historic elements while preserving the informal setting of the community.

Bridges - Ability for public access directly to the creek water edge were provided through the use of two small pedestrian bridges which also provided a pedestrian link between both banks of the river corridor.

Natural Streambed Corridor - An artificial streambed was developed to function as the prominent water feature within the river corridor. The streambed alignment was developed to model the behavior of a natural stream system, with the appropriate meanders, variable stream width, and sequence of ripples and pools. The creation of the streambed section will be constructed with a PVC liner foundation overlaid with a protective soil cement lining, and large cobbles or boulders developing the variable stream edge interface. A riffle and pool sequence allowed vertical elevation change at these locations in the streambed profile while providing cascading flow and water movement.

Energy Dissipation / Grade Control Structure - The upstream interface between the existing engineered concrete trapezoidal channel required dissipation of the water velocity, which was on the order or 30 fps, prior to entering the natural river corridor area. The overall streambed gradient was adjusted to ensure that the velocities in the natural stream area were within a range of 5 to 8 fps.

Recirculating Water and Low-Water Diversion System - Concerns regarding the existing poor creek water quality and the ability to sustain year-round flow in this

semi-arid climate for the creek water feature were addressed through a self-contained flow recirculation system. Domestic or clean well water would be recirculated within the constructed streambed during dry weather periods, while the inflowing nuisance water from the upper watershed would be diverted around the creek walk area through an underground storm drain system.

Plantings and Landscaping - The plantings incorporated into the landscaping were selected to model the native plants communities of this area, recreating a natural landscape and riverine environment. A survey of the watershed developed an inventory of the common native plant materials in the riparian and adjacent upland zones. The river corridor focused on developing a non-engineered landform that integrates with the waterform.

### CREEKWALK VISION

The anticipated payoff to the City of Vista is an economic revitalization of the downtown area with the **Creek Walk** providing a unique setting for leisure, recreation, and entertainment, while attracting new investment into the community and economic growth. The restoration attempts to reestablish the original Buena Vista Creek to the natural riverine environment while creating an attractive interface through the application of urban design principles to an aging flood control facility. The Creek Walk will become an active part of the community fabric and a prominent landmark feature for future generations to enjoy.

