REVITALIZE THE RIVER

Los Angeles River near Weddington Park. (2006)
This chapter describes proposals for a revitalized Los Angeles River.

The long-term vision for the River involves restoring a continuous, functioning riparian ecosystem along the River corridor within the project area. This would involve restoring riparian vegetation to support birds and mammals, and ideally, developing fish ladders and riffle pools to allow for restoration of steelhead trout habitat, though this may take many years and coordination with downstream cities.

In the near-term, channel walls are modified to provide green landscaped terraces for wildlife habitat, water quality treatment, and public enjoyment. A system of pathways and overlooks provides public access.

Accomplishing long-term improvements will involve expanding channel capacities and reducing flow velocities. These will be achieved through a combination of flood storage outside the channel in retention basins and underground box culverts, and, over the long-term, potential repurchase of private property to allow for channel widening.

Legend
- Potential Regional Level Treatment Sites
- Potential Locations for Water Quality Treatment Terraces
- Potential Rubber Dam Locations
- River Channel Reaches
  1: Confluence to Sepulveda Basin
  2: Sepulveda Basin
  3: Sepulveda Basin to Tujunga Wash
  4: Tujunga Wash to Barham Blvd
  5: Barham Blvd to Burbank Western channel
  6: Burbank Western Channel to Taylor Yard
  7: Taylor Yard
  8: Taylor Yard to 1st Street
  9: 1st Street to Washington Blvd

Base Info Legend
- Existing Open Space
- Limit of Geographical Data Set
- Metro Gold Line
- Metro Gold Line Eastside Extension
- Metro Red Line
- Metro Orange Line
- Metro Blue Line
- Station Symbol
**GOALS AND RECOMMENDATIONS SUMMARY**

### Preconditions for Revitalization
- **Goal: Enhance Flood Storage**
  - Recommendation #4.1: Identify opportunities for peak flood storage outside the channel to reduce flow velocities in the River to sub-critical (less than 12 feet per second) levels. This will support the maintenance and reestablishment of vegetation.

### Near-Term Improvements
- **Goal: Enhance Water Quality**
  - Recommendation #4.3: Emphasize multiple-benefit landscape treatments and "green infrastructure" improvements.
  - Recommendation #4.4: Implement water quality treatment at multiple scales to maximize efficiency.
  - Recommendation #4.5: Create landscape-based water quality treatment at major confluences of the River to treat pollutants carried by tributaries.
  - Recommendation #4.6: Develop "treatment terraces" within the channel to treat stormwater flows that "daylight" or surface in the River.
  - Recommendation #4.7: Create landscape-based "green strips" at the top of Riverbanks and in adjacent linear parkland and streets to treat stormwater runoff from streets.

- **Goal: Enable Safe Public Access**
  - Recommendation #4.8: Provide opportunities for safe access to the water, ensure that people can quickly exit the channel, and establish a flood warning system in the event of high flow conditions.

- **Goal: Restore a Functional Riparian Ecosystem**
  - Recommendation #4.13: Create a continuous functional riparian corridor that provides habitat for birds, mammals, amphibians, reptiles, invertebrates, and fish within the channel bottom.
  - Recommendation #4.14: Connect this corridor to other significant habitat and migration routes along the tributaries and into the mountains.
  - Recommendation #4.15: Improve water quality and provide fish passages, ladders, and riffle pools that would support desirable fish species, including steelhead trout if feasible.
  - Recommendation #4.16: Bio-engineer the River’s edge where feasible to create and restore wildlife habitat along the upper reaches of the River.

### Long-Term Vision
- **Goal: Enhance Water Quality**
  - Recommendation #4.9: Provide opportunities for temporary pools and lakes for water-based recreation by installing inflatable rubber dams.
  - Recommendation #4.10: Create a variety of public spaces, including small pocket parks, natural areas, and urban plazas and civic spaces in "reclaimed" areas of the channel.
  - Recommendation #4.11: Ensure public safety by using alternate "greening" techniques in areas where the concrete remains necessary for flood damage prevention.
  - Recommendation #4.12: Continue development of non-motorized transportation and recreation elements including bike and pedestrian paths and multiuse trails in the River and tributary rights-of-way.

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**Flood along the Cherry Creek in Denver, Colorado (2006)**

**Water quality treatment wetlands at Augustus F. Hawkins Park (2006)**

**Linear park and bikeway at Ballona Creek, Playa del Rey (2006)**

**Soft-bottomed portion of the Los Angeles River, near Los Feliz Boulevard in Los Angeles (2006)**

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**Goal: Enhance Flood Storage**

**Goal: Enhance Water Quality**

**Goal: Enable Safe Public Access**

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**Preconditions for Revitalization**

**Near-Term Improvements**

**Long-Term Vision**
A PHASED APPROACH TO RESTORATION AND REVITALIZATION

THE CHALLENGE

Achieving the long-term revitalization goal of restoring the River’s riparian corridor and ecological function is a goal that may take generations to achieve. As land in the watershed is developed or redeveloped with greater diversity and more impervious surfaces, stormwater runoff has fewer places to be absorbed or retained, and the volume, velocity, and temperature of water in the River channel increases, along with pollutants. Substantial increases in channel capacities and reductions in flow velocities will be necessary to naturalize stretches of the River, which may take many years to accomplish. In the meantime, the Plan recommends identifying and phasing improvements that could be made in the near-term to maintain momentum and to demonstrate the ecological and public-access benefits of revitalization.

RECOMMENDATIONS

To ensure that improvements can be made in the near-term, the Plan proposes a phased, “top down” approach for ecological restoration projects that would construct water quality terraces, natural areas that provide habitat, overlooks, and pathway connections. These features can be introduced with minimal changes to the existing channel configuration. Over the long-term, as funding is made available to increase channel capacity and reduce flow velocities, the channel section might be modified further to reintroduce a functional riparian corridor in the channel bottom. The intent to install long-term improvements without having to fully replace near-term improvements is facilitated by working top-down.

The images on this page and the facing page illustrate how this top-down phasing strategy might work. The first image in each row depicts existing channel conditions, the second image includes possible near-term improvements, and the third illustrates long-term restoration possibilities. As illustrated, near-term improvements (A) incorporate public access, bike paths and pedestrian trails, wildlife habitat, and water quality treatment at or slightly below the top of the existing bank. Longer-term improvements (B) restore ecological function through reintroduction of a riparian corridor in the bottom and side terraces of the channel. The Plan recommends an adaptive management approach to phasing, implementing this top-down approach in selected pilot or demonstration sites, and evaluating and incorporating what is learned about guidelines for restoration in future efforts.
PRECONDITIONS FOR RESTORATION

- A reduction in peak water flow velocity to 12 feet per second or less will help riparian vegetation to become reestablished. Some periodic scouring is still expected to occur under this flow regime, and is in fact desirable for a healthy ecosystem.

- Until flow velocities can be reduced, introduction of vegetation above the 50-year flood water surface elevation will minimize maintenance and washouts. The intent of this criterion is to define a reasonably rare event that represents an acceptable level of maintenance risk.

NEAR-TERM IMPROVEMENTS

- Improvements at or near the top of the existing banks might include water quality "green strips" and tree plantings that provide wildlife habitat, shade, and cover.

- Improvements within the channel might include in-channel water quality treatment terraces, trails or overlooks, pocket parks or native areas, and temporary ponded areas.

LONG-TERM IMPROVEMENTS

- Longer-term modifications entail reconstructing the channel bottom and lowering banks to provide a pool and riffle system for steelhead trout or other fish, and to reestablish a riparian corridor.
RECOMMENDATIONS

Recommendation #4.1: Identify opportunities for peak flood storage outside the channel to reduce flow velocities in the River to sub-critical (less than 12 feet per second) levels. This will support the maintenance and reestablishment of vegetation at this maximum level.

Recommendation #4.2: Identify opportunities for selective acquisition of additional rights-of-way to expand the River’s floodplain.

Estimated Water Storage Needs to Reduce River Flow Velocities

Each rectangle is a scaled representation of the number of acres required to reduce River flow velocities to sub-critical levels in different areas along the River. The numbers are based on analysis (Tetra Tech, August 2006) that considered the portion of the hydrograph peak that needed to be stored to maintain velocities of 12 feet per second or less in the channel, based on inflow from each tributary. This illustrates what storage would be necessary if no other channel or watershed changes take place.

The storage area required has been analyzed on a gross level and indicates general storage requirements desired for velocity reductions. When feasible, storage facilities should be located as close as possible to the mainstem of the River to increase the effectiveness of the storage volume.
One of the most important issues influencing the planning process is the need to maintain existing flood-control capacity. Residents who experienced the River during a significant flood have expressed the need for assurances that any proposed improvements would not increase the possibility of flood hazards. The Los Angeles County Department of Public Works and the U.S. Army Corps of Engineers, in partnership with the City, will not permit improvements that would compromise existing flood control in the River channel.

Restoring wildlife habitat and vegetation within the River channel, and providing for recreational improvements, would require additional and compensatory flood capacity. Introducing vegetation in the River bottom, for example, will require the channel capacity to expand by one and one-half to five times its present width depending on the type and extent of vegetation used.

Recommendation #4.1: identify opportunities for peak flood storage outside the channel to reduce flow velocities in the River to sub-critical (less than 12 feet per second) levels. This will support the maintenance and reestablishment of vegetation.

Previous planning efforts have emphasized the value of reducing stormwater runoff and adding flood storage capacity. Previous studies have also addressed the benefit that may be realized by detaining water in existing reservoirs, basins in the mountain areas, and even storage resulting from increased forest growth (US Army Corps of Engineers, 1991; Tetra Tech, Inc., 1997). The current study has established specific performance goals that identify the approximate amount of storage required to achieve a defined level of benefit. Since a major driver of this Plan is to reduce flow velocities to a sub-critical level of 12 feet per second or less in order to sustain and restore riparian ecosystems, this performance criterion has been used to develop and map estimates of the land area required for storing peak water flows. Twelve feet per second is herein considered the upper maximum flow velocity to maintain a stable channel cross-section, and may still require bio-engineered slope protection. This twelve feet per second design criterion will be validated through the U.S. Army Corps of Engineers Los Angeles River Ecosystem Feasibility Study. It will be revised as warranted by these evaluations.

Flows within the Los Angeles River incorporate inflows from the tributaries, so the approximate land area requirements for storage are mapped geographically, and reach by reach, to take into account increasingly larger volumes of water in the channel as flow continues downstream. The map on the facing page illustrates the storage required in each area to reduce flows to 12 feet per second or less. The boxed areas are scaled representations of the land area required, assuming basins that are ten feet deep. It is important to note that land area requirements identified in the downstream reaches are dependent on the storage capacities that are indicated upstream.

The map on the facing page illustrates the acres of land required in each area, these range from under 100 acres in portions of the upper San Fernando Valley, and between Sepulveda Dam and Tujunga Wash, to much more significant requirements in the range of 600 -- 1,800 acres downstream, as flows accumulate from Tujunga and Verdugo Washes and the Arroyo Seco.
Opportunities for peak-flood storage outside the channel most likely will be found in the following locations:

- In the upper San Fernando Valley, between the point of origin of the Los Angeles River in Canoga Park and the Sepulveda Basin, where land area requirements are small and may be more readily attained.

- Within the Sepulveda Basin itself, through selective excavation over time. The Basin encompasses approximately 2,500 acres of Federally-owned land that is leased to the City and provides extensive area for potential storage. Any excavation will need to be accomplished in phases to minimize disruption to existing uses and to ensure that the function of existing uses are maintained or restored. Further, storage would need to be coordinated with the Basin’s outlet operations so that water may be released if necessary.

- Between Sepulveda Basin and Tujunga Wash, assuming the needed upstream storage can be accomplished within the Basin itself.

- Through a combination of storage areas along the Tujunga Wash and possibly at the confluence, because so much water enters the River from this tributary.

Ultimately, stored water could be used for irrigation or infiltration. Other downstream areas may offer selective benefits (for example, the Spreading Grounds, or Taylor Yard), but the associated land areas are much smaller, and consequently would accommodate less water unless basins were quite deep.

The figures on the previous pages illustrate the acres of off-channel storage needed to achieve design criteria, but it should be noted that off-channel storage is not envisioned as the only means of accomplishing these goals. Other strategies include upstream and within-watershed volume reduction through the implementation of on-site stormwater control measures; storage off-channel upstream in the tributaries; and expansion of capacity through deepening the channel or through construction of additional underground box culverts.

Practical considerations associated with transitioning flows into and out of the culverts from the channel suggest that this approach is not viable as the sole strategy. Securing additional capacity to contain flood water in culverts would be most effective as part of a strategy that also incorporates peak flow storage outside the channel, as well as channel widening.
Recommendation #4.2: Identify opportunities to selectively acquire additional rights-of-way to expand the River’s floodplain.

A third method exists for providing adequate flood storage capacity to restore habitat in the channel bottom. This involves acquiring additional land area to either widen the channel or to create public open areas that effectively re-creates the floodplain.

An analysis of the additional land required to slow flows to 12 feet per second or less indicated that an estimated 150 to 250 feet of additional River width would be needed above Tujunga Wash. Below Tujunga Wash, approximately 600 feet of additional River width would be needed, and even more needed below Verdugo Wash.

This analysis suggests that land acquisition could represent one component of a long-range strategy for restoring functional habitat within the Los Angeles River, either as a primary strategy or in combination with off-channel storage and underground culverts. Complimentary efforts that occur watershed-wide are also critical to reducing the required capacity of the channel for specific storm events.

Additional benefits included in a long-term strategy for land acquisition include, increased opportunities for installation of stormwater treatment facilities, habitat restoration, reconfiguration of the channel to allow for possible future Steelhead Trout migration, recreation including bicycle paths and pedestrian trails, open space, ball fields, and possibly groundwater recharge.

The confluence of the Los Angeles River (on the right) and Tujunga Wash could provide another opportunity for peak-flow storage, and would have an especially beneficial effect given the volume of inflows from Tujunga Wash. (2006)
**RECOMMENDATIONS**

Recommendation #4.3:
Emphasize multiple-benefit landscape treatments and “green infrastructure” improvements.

Recommendation #4.4:
Implement water quality treatment at multiple scales to maximize efficiency.

Recommendation #4.5:
Create landscape-based water quality treatment at major confluences of the River to treat pollutants carried by tributaries.

Recommendation #4.6:
Develop “treatment terraces” within the channel to treat stormwater flows that “daylight” or come to the surface in the River.

Recommendation #4.7:
Create landscape-based “green strips” at the top of Riverbanks and in adjacent linear parkland and streets to treat stormwater runoff from streets.

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The graphic above shows potential locations of large, regional-scale, water-quality-treatment wetlands at the confluences of major tributaries, or on City-owned land adjacent to the channel. It also shows locations of major stormwater flows (30 to 60 inches in diameter) that might be served by in-channel water quality “treatment terraces.”
GOAL: ENHANCE WATER QUALITY

THE CHALLENGE

Improving water quality is a major priority of this Plan. With the increasing urbanization of Los Angeles, the quality of the water in the River has declined significantly. Most of this is due in large part to untreated stormwater runoff that is allowed to enter the River through one of approximately 2,200 storm drain outlets. Agricultural, industrial, and residential development over the past century, along with the use of pesticides, fertilizers, and household chemicals, have resulted in degradation of surface and ground waters within the region. Analysis indicates that water quality is poor in all reaches of the Los Angeles River considered in this Plan.

The Plan proposes a comprehensive system of water quality treatment facilities that includes regional treatment, in-channel treatment, and on-site controls to deal with both runoff reduction and water quality treatment. In this regard, proposals are consistent with the Integrated Resources Plan, the Integrated Regional Water Management Plan, the City’s Stormwater Management Plan (currently underway), and is intended to be consistent with future City efforts at developing sub-area “loadings” of pollutants flowing to the River.

General locations for regional and in-channel treatment are specified, and illustrated sizing criteria and performance for in-channel treatment terraces have been evaluated to assess the feasibility of the concept. The in-channel water quality “treatment terraces” would be constructed above the elevation of a 50-year flood to minimize anticipated maintenance. The 50-year flood standard is viewed as a comparatively rare event that represents an acceptable level of maintenance risk from washout. While treatment within the channel does not provide credit toward Total Maximum Daily Load (TMDL) requirements, this Plan recommends that the City work with the Regional Water Quality Control Board to change this policy so that in-channel treatment could satisfy TMDL compliance requirements in the future.

A logical next step as the Plan moves forward into implementation is to develop specific pollutant removal targets for each type of constituent considered, and to develop removal goals for each geographic reach and for each scale of treatment. This must, of necessity, be coordinated among all of the planning efforts listed above, so that each effort reinforces the other.

Moreover, because many of these plans deal with treatment upstream in the watershed, either along a tributary or at a private, on-site location, performance goals need to be established that take this into consideration. This would entail defining treatment areas within the watershed at a level of specificity that was beyond the scope of this Plan. However, it is a very important “next step” in the development of an integrated, watershed-wide stormwater strategy. As noted repeatedly, the River cannot and should not be expected to be the treatment location “of last resort” for stormwater runoff originating elsewhere in the watershed.

An integrated approach to developing runoff reduction and water quality treatment goals would also be helpful in attempting to quantify benefits associated with conservation and groundwater recharge within the watershed. Captured and conserved, that water would have tremendous value for augmenting the region’s water supply. It is possible that the system-wide deployment of these projects could generate for other required water infrastructure systems enough local water value and savings to finance a major portion of this Plan’s implementation.

RECOMMENDATIONS

Recommendation #4.3: Emphasize multiple-benefit landscape treatments and “green infrastructure” improvements.

Landscape-based treatment strategies can play significant roles in helping the City comply with Total Maximum Daily Load (TMDL) requirements that govern the amount of pollutants allowed to enter the River. Landscape-based treatment can be especially effective in addressing nutrients and, to some degree metals. These areas may be used in conjunction with and adjacent to other landscape features to additionally provide aesthetic value, active and passive recreation, and habitat.

When treatment wetlands provide habitat for wildlife, it is important to apply careful design and maintenance practices that avoid exposure to high concentrations of nutrients, metals, and other harmful elements. As suggested in earlier studies (e.g., California State Coastal Conservancy, 2002), pilot projects should be undertaken to allow for sound science and adaptive management to guide recommendations for construction and management of treatment wetlands.

CONCURRENT PLANNING EFFORTS

- Both the Integrated Resources Plan (IRP) and the Integrated Regional Water Management Plan (IRWMP) call for reduction and reuse of stormwater runoff volumes through onsite measures, such as reducing impervious surfaces or using other Best Management Practices (BMPs) to capture, treat, and infiltrate storm runoff.

- Both the IRP and the IRWMP advocate capturing and treating remaining stormwater runoff from developed areas at or near the source. Both plans emphasize multi-purpose solutions that support functional wildlife habitat, provide for recreation, and support groundwater recharge where appropriate.

- Both the IRP and the IRWMP advocate a systematic approach to water quality enhancement throughout the watershed, treating runoff on-site on both public and private sites, and using public properties, including parks, schools, and civic sites, as treatment facilities.
Recommendation #4.4: Implement water quality treatment at multiple scales to maximize efficiency.

The Plan recognizes that water quality treatment should be accomplished at multiple scales to maximize efficiency. It proposes a three-tiered system involving 1) regional-scale treatment at major confluences or on large City-owned properties, 2) treatment of stormwater emerging from major storm drains within “water quality treatment terraces” constructed in the River channel or immediately adjacent to the channel, that would be located in available open space/parkland, and 3) local or site-level treatment of surface drainage. These are illustrated in the recommendations that follow.

On-site and neighborhood source controls as well as treatment upstream within the tributaries are an especially important component of this three-tiered system. As stated in Chapters 3 and 4, the River cannot solve all of the water quality problems arising within the watershed. The Plan encourages development of comprehensive policies, consistent with the City’s Stormwater Management Plan (in progress), that support on-site source controls that will minimize and treat stormwater runoff at the point of origin.

Recommendation #4.5: Create landscape-based water quality treatment at major confluences of the River to treat pollutants carried by tributaries.

Regional-scale treatment includes treatment of stormwater flows along the tributaries and their confluences, and within larger land areas along or outside the channel that could be harnessed for treatment purposes. Because of their large size and treatment of more substantial pollutant loads, these regional facilities offer the potential for economies of scale. The confluence areas also can provide multiple benefits if they help to reestablish wildlife habitat.

Opportunities for regional-scale water quality treatment within the Plan’s study area include:

- **Sepulveda Basin**: The Basin provides significant land area that could be used for water quality treatment and habitat improvement.
- **Tujunga Wash and its confluence with the Los Angeles River**: Reports developed for the Sun Valley Watershed Management Plan identify upstream areas that could be used for flood storage as well as water quality treatment. A treatment facility also might be effective at the confluence, if land were to become available.
- **Golf Courses**: Several golf course properties within the Plan area are adjacent to the River. Opportunities may exist in the future to create sand filters and underdrain systems below golf courses, that would cleanse runoff before it enters the River.
- **The Spreading Grounds**: Water quality treatment could be incorporated into this site near Griffith Park.
- **Verdugo Wash and Confluence with the Los Angeles River**: Approximately 15 acres could be purchased at the confluence for significant water quality treatment, similar to Tujunga Wash. Upstream opportunities for treatment within the Wash also should be investigated.
- **Taylor Yard**: If purchased, the 42-acre G2 parcel could be reconfigured for significant water quality treatment.

**How Effective Are Water Quality Treatment Terraces?**

Efforts to quantify treatment capacities of water quality terraces constructed in the River channel indicate that they are most effective during very low-flow conditions, such as runoff from lawn irrigation, or the first one-half to three-quarter inch of rainfall. For example, a typical vegetated area of 100 by 20 feet, with 1 to 2 cubic feet per second of inflow during dry weather could potentially remove an estimated 50 percent of the metal load. (Note that the amount of load reduction depends on where BMPs are located, the relative flow of water to the BMP, the amount of loading of constituents for the subarea, and the specific BMP being used.)
**Arroyo Seco Confluence**: City-owned lands could be used to demonstrate site-specific water quality treatment. Over the long term, areas in public ownership could be reconfigured to provide more significant water quality treatment benefits.

As part of a regional-scale water quality treatment strategy, City-owned property could be modified to provide water quality treatment, following the precedent set by the Potsdamer Platz project, in Berlin, Germany. Runoff from building roofs and parking areas is captured and stored in underground cisterns, then brought to the surface, treated, and used to irrigate native landscapes. The City-owned lands at the Arroyo Seco confluence offer a significant opportunity to demonstrate this approach, and can produce real and substantial flood management and water quality benefits.

**Recommendation #4.6**: Develop “treatment terraces” within the channel to treat stormwater flows that “daylight” or surface in the River.

“Outfall-level” treatment focuses on the concentrations of storm drains that “daylight” or emerge into the River. One solution is to provide water quality treatment terraces within the River channel, above the 50-year storm elevation, to treat low flows from large capacity storm outfalls before the stormwater is discharged into the River. Again, the 50-year elevation has been chosen simply because it represents a reasonably rare event and potentially acceptable level of maintenance risk.

Storm outfalls (or pipes through which stormwater emerges) ranging in size from 30 to approximately 60 inches are most appropriate for treatment terraces, though the size of the pipe does not necessarily correlate with runoff volume during low-flow conditions. These larger pipes do, however, tend to be used for larger drainage areas that may convey more pollutants, even during low flows. In situations where these high-volume storm outfalls are located below the elevation of the treatment terrace, photovoltaic pumps could be used to raise the water to the terrace.

This proposed in-channel treatment does not qualify for compliance with TMDL requirements, because flows are required to be treated before they enter the River channel. However, the Plan recommends discussions with the Regional Water-Quality Control Board to define the channel for the River as the low flow or constant-flow elevation, thereby allowing treatment terraces to assist in TMDL compliance.

**Recommendation #4.7**: Create landscape-based “green strips” at the top of Riverbanks and in adjacent linear parkland and streets to treat stormwater runoff from streets.

“Green strips” or bioinfiltration gardens, within the existing River right-of-way and on adjacent parkland can treat surface runoff from adjacent streets prior to flowing into storm drains or the River.

The Plan recommends the use of site-specific water quality BMPs for City-owned and public facilities (for example, parks and schools), as well as residential and commercial areas. Infiltration strips along street medians or curbside infiltration areas can intercept street runoff before flow enters catch basins and storm drains. With heavier rainfall or when street flow exceeds the capacity of the infiltration areas, runoff would bypass the diversion and enter the catch basin system. These diversions could be as simple as small humps in the gutter before the catch basin locations that direct flow into curbside green strips. These smaller-scale solutions can complement regional and outfall-level treatment facilities, though they treat smaller volumes and maintenance may cost more because they are small and distributed over larger areas.

Finally, the Plan endorses the use of the Stormwater Best Management Practice Handbooks, published by the California Stormwater Quality Association, and other suitable publications for guidance in designing and implementing project-specific construction Stormwater Management Plans. Where appropriate, consultation with the Regional Water Quality Control Board would be undertaken with respect to the introduction of BMPs.
RECOMMENDATIONS

Recommendation #4.8:
Provide opportunities for safe access to the water, ensure that people can quickly exit the channel, and establish a flood warning system in the event of high flow conditions.

Recommendation #4.9:
Provide opportunities for temporary pools and lakes for water-based recreation by installing inflatable rubber dams.

Recommendation #4.10:
Create a variety of public spaces, including small pocket parks, natural areas, urban plazas, and civic spaces, in “reclaimed” areas of the channel.

Recommendation #4.11:
Ensure public safety by using alternate “greening” techniques in areas where the concrete remains necessary for flood damage prevention.

Recommendation #4.12:
Continue development of non-motorized transportation and recreation elements including pedestrian paths and multiuse trails in the River right-of-way and its tributaries.

The graphic above shows potential locations for ponds or impoundments created by installing inflatable rubber dams. Actual locations will be determined when the design of proposed improvements is complete.
GOAL: ENABLE SAFE PUBLIC ACCESS

THE CHALLENGE

More than 70 percent of Los Angeles residents do not live within a quarter-mile of a park or open space. This standard metric, popularized by the Trust for Public Land, has been incorporated in many cities’ parks and open space systems. Reshaping the River corridor to create small pocket parks and open space can help the City provide more of these public amenities within walking distance.

RECOMMENDATIONS

The Plan offers four recommendations for making more effective use of the River as a more accessible recreation and open space asset. These recommendations consider the River, as noted landscape architect Frederick Law Olmsted did in the 1920’s, as the spine of a city- and region-wide system (described in more detail in Chapter Five).

Recommendation #4.8: Provide opportunities for safe access to the water, ensure that people can quickly exit the channel, and establish a flood warning system in the event of high flow conditions.

People are drawn to water, especially in areas like Los Angeles, which has extreme variations in moisture. Many residents who attended the public meetings for the Revitalization Master Plan recalled how they or their acquaintances played, fished, and swam in the River years ago. And the lure still exists, especially for children, though there are compelling concerns about safety and security when flood waters rise.

Public access to a city’s river is the norm in many countries and throughout most of the United States. Along the Wien River in Vienna, Austria, the riverbed is used for festivals and candlelight dinners during the dry season. Seoul’s Cheonggyechon River (a 2006 “Sister River” of the Los Angeles River) incorporates multi-purpose pathways at the river’s edge, while the Rio Besos in Barcelona – which exhibits hydrologic conditions very similar to the Los Angeles River -- allows extensive recreational access yet provides a variety of warning systems so that visitors can safely exit in the event of flooding forecasts.

The Plan considers public safety as a critical priority and endorses the County Master Plan’s recommendation that jurisdictional partners (the City, the County, and the Corps) work actively to develop strategies and design standards for safe access to the River. Appropriate measures may include endorsing common design standards for channel modifications – including stepped or terraced access, access-ramp surfacing and interval spacing, and safety fencing – that allow people to reach the water’s edge, yet easily exit in the event of forecasted rain.

Other measures that should be adopted include designing multiple, redundant, warning systems, including signage, horns, warning lights, radio announcements, and physical patrols, that would notify nearby users that higher flow is anticipated. Multiple systems that do not rely entirely on signage are viewed as important to protect the safety of the public, children in particular, who might otherwise ignore a sign.

Recommendation #4.9: Provide opportunities for temporary pools and lakes for water-based recreation by installing inflatable rubber dams.

Community members also expressed an interest in selectively ponding areas of the River on a temporary, short-term basis using inflatable rubber dams. Rubber dams and gates frequently are used to detain water for infiltration or raise the water elevation. They could be lowered during high flows as long as the bottom surface of the channel remains smooth during peak-flow conditions. Over the long-term, pools and riffles will be created within the channel to restore habitat for fish, amphibians and invertebrates. A four-to-five foot-high structure would pond water back approximately one-half-mile, depending on the grade at any specific location of the channel. The County has used rubber dams and gates successfully on the San Gabriel River. The Orange County Water District has constructed them on the Santa Ana River, and the City of San Antonio uses them to divert water into the Riverwalk.

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People are drawn to water, especially in areas like Los Angeles, which has extreme variations in moisture. Many residents who attended the public meetings for the Revitalization Master Plan recalled how they or their acquaintances played, fished, and swam in the River years ago. And the lure still exists, especially for children, though there are compelling concerns about safety and security when flood waters rise.

Public access to a city’s river is the norm in many countries and throughout most of the United States. Along the Wien River in Vienna, Austria, the riverbed is used for festivals and candlelight dinners during the dry season. Seoul’s Cheonggyechon River (a 2006 “Sister River” of the Los Angeles River) incorporates multi-purpose pathways at the river’s edge, while the Rio Besos in Barcelona – which exhibits hydrologic conditions very similar to the Los Angeles River -- allows extensive recreational access yet provides a variety of warning systems so that visitors can safely exit in the event of flooding forecasts.

The Plan considers public safety as a critical priority and endorses the County Master Plan’s recommendation that jurisdictional partners (the City, the County, and the Corps) work actively to develop strategies and design standards for safe access to the River. Appropriate measures may include endorsing common design standards for channel modifications – including stepped or terraced access, access-ramp surfacing and interval spacing, and safety fencing – that allow people to reach the water’s edge, yet easily exit in the event of forecasted rain.

Other measures that should be adopted include designing multiple, redundant, warning systems, including signage, horns, warning lights, radio announcements, and physical patrols, that would notify nearby users that higher flow is anticipated. Multiple systems that do not rely entirely on signage are viewed as important to protect the safety of the public, children in particular, who might otherwise ignore a sign.

Recommendation #4.9: Provide opportunities for temporary pools and lakes for water-based recreation by installing inflatable rubber dams.

Community members also expressed an interest in selectively ponding areas of the River on a temporary, short-term basis using inflatable rubber dams. Rubber dams and gates frequently are used to detain water for infiltration or raise the water elevation. They could be lowered during high flows as long as the bottom surface of the channel remains smooth during peak-flow conditions. Over the long-term, pools and riffles will be created within the channel to restore habitat for fish, amphibians and invertebrates. A four-to-five foot-high structure would pond water back approximately one-half-mile, depending on the grade at any specific location of the channel. The County has used rubber dams and gates successfully on the San Gabriel River. The Orange County Water District has constructed them on the Santa Ana River, and the City of San Antonio uses them to divert water into the Riverwalk.
PROVIDING SAFE PUBLIC ACCESS TO THE RIVER

Presently, public access to the River is limited for safety and liability reasons. When the River was channelized, it was also fenced off to prevent people from falling in or from being swept away during floods. This fencing has been breached in many locations and, in several areas, the River has become a location for homeless encampments and gang activity.

Encouraging more beneficial use, while ensuring public health and safety through a variety of measures, could reduce these undesirable activities and make the River an amenity for all residents of Los Angeles.

The rubber dams are envisioned as intermittent, so that the water elevation behind the dams is maintained for aesthetics and recreation when prudent. The dams would be used only when water would not be allowed to stagnate or interfere with flood capacity. As a riparian corridor is developed within the channel bottom, the continued use of rubber dams or other temporary ponding devices would be evaluated for its effect on habitat quality, and where necessary to support habitat goals, these devices would be discontinued.

The figure on 4-14 suggests areas where rubber dams might be installed. Because rubber dams are a technique that could be implemented in almost any location along the River, providing that flow requirements are met, the Plan includes recommendations that locations be selected on the basis of providing visibility and public access. In addition to rubber dams, the opportunity exists to construct very low-elevation (6 to 12 inches) concrete “speed bumps” that would ramp up and back down along the channel bottom. These would allow very shallow ponding to improve the aesthetics of the channel. This concept needs further analysis to ascertain its feasibility.

The Plan recommends that water quality efforts be targeted toward maintaining the River’s “Rec 1” beneficial-use designation. This would allow for safe and consistent implementation of recommendations for water-based recreation and use, including recreational boating. The Cornfields-Chinatown reach, because it is the steepest section of the River, may offer natural opportunities for a kayaking course (illustrated in Chapter Six).

Recommendation #4.10: Create a variety of public spaces, including small pocket parks, natural areas, and urban plazas and civic spaces, in “reclaimed” areas of the channel.

This recommendation closely echoes recommendations made in the 1996 County Master Plan, regarding identifying areas in the River right-of-way that could be reshaped to provide more green space in neighborhoods that are especially park-deficient.

Similar to water quality treatment terraces, the existing channel right-of-way might be modified to create small terraced pocket parks and native landscaped areas that could vary in width from 20 to 35 feet, based on the amount of right-of-way available.
Recreational terraces would be landscaped with native vegetation and would be suitable for more passive activities. Consistent with recommendations made in previous plans, these pocket parks and related public-use areas would be considered first in the neighborhoods most deficient in usable park space, and be “reserved” mostly for areas where they can be easily and safely used. Planning efforts to create new parks along the River should encourage spontaneous, community-driven projects that are consistent with the overall vision and objectives set forth in this Plan.

Recreational terraces would be installed no lower than the 50-year flood elevation and would minimize the proportion of trees and shrubs installed to reduce maintenance and the likelihood of washouts. In many locations, the 50-year flood elevation is approximately four to six feet below the top of the existing bank, a “human-scale” distance that separates the River from adjacent streets or activity, but does not make people feel isolated and unsafe.

Pathways, ramps, and steps would be constructed to provide safe access to these terraces from the top of the existing bank. Pathways and ramps would be accessible according to guidelines established by the Americans with Disabilities Act (ADA) at approximately one-quarter mile intervals. They could also provide for supplemental maintenance access by connecting with existing maintenance roads at the top of the bank.

Recommendation #4.11: Ensure public safety by using alternate “greening” techniques in areas where the concrete remains necessary for flood damage prevention

To provide an improved aesthetic environment for the concrete-lined channel in areas where the concrete needs to remain in order to protect life and property from flooding, the Plan advocates drawing on existing City precedents for greening freeway retaining and sound walls with hanging vines. These will improve the appearance of the River and could be more readily replaced in the event of flooding (than more permanent vegetation, such as shrubs or trees). This type of channel “greening” can occur in the short-term until long-term alternatives for construction and land acquisition can be implemented.

Recommendation #4.12: Continue development of non-motorized transportation and recreation elements including bike and pedestrian paths and multiuse trails in the River right-of-way and its tributarries.

This recommendation will be discussed in more detail in the Creating a Continuous River Greenway section of Chapter 5.
RECOMMENDATIONS

Recommendation #4.13:
Create a continuous functional riparian corridor that provides habitat for birds, mammals, amphibians, reptiles, invertebrates, and fish within the channel bottom.

Recommendation #4.14:
Connect this corridor to other significant habitat and migration routes along the tributaries and into the mountains.

Recommendation #4.15:
Improve water quality and provide fish passages, ladders, and riffle pools that would support desirable fish species, including steelhead trout if feasible.

Recommendation #4.16:
Bio-engineer the River’s edge where feasible to create and restore wildlife habitat along the upper reaches of the River.

Potential Restoration Opportunities

This map shows the potential restoration opportunities within the River Channel. The numbers on this map correspond to the potential River project matrix and maps at the end of this document. Note: Locations of habitat opportunities can be found more precisely in detailed reach maps presented in Chapter 10.
GOAL: RESTORE A FUNCTIONAL RIPARIAN ECOSYSTEM

THE CHALLENGE

As stated previously, according to the California Coastal Conservancy, close to 100 percent of the original wetlands and 90 to 95 percent of in-stream riparian habitat have been lost within the Los Angeles watershed, a consequence of urbanization and the channelization of rivers and creeks. Within the 32-mile Plan area, the only areas that support riparian habitat are the Sepulveda Basin, the reaches near Griffith Park, and the Glendale Narrows. These areas are increasingly stressed by invasive and non-native species, hydrologic modifications, dumping of trash and debris, and encroaching development.

Because functional riparian habitat and wetlands can improve water quality by removing or sequestering many contaminants, the loss of this habitat has implications for the ecological functioning of the River, as well as for wildlife uses.

Aquatic habitat has also been severely degraded as the River has evolved from a natural system to a paved flood conveyance channel. Habitat is limited and not connected, and the River’s hydroecological function has been affected by channelization. Species affected include the red-legged frog, and most significantly, the steelhead trout. The main barrier to the steelhead trout’s “recolonization” of the River is not temperature or water quality – though these are factors – but an unimpeded path from the ocean to the headwaters, and areas in which to rest and spawn. Such an unimpeded pathway would require removing enough of the concrete within the channel to allow a fish to journey from the ocean to the headwaters, and areas in which to rest and spawn. Such an unimpeded pathway would require removing enough of the concrete within the channel to allow a fish to journey from the ocean to the headwaters, and areas in which to rest and spawn. 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This Plan adopts the restoration of a functional riparian corridor, including riffle pools and runs to support fish, as a long-term goal. Currently, restoration of a functioning ecosystem will require major changes to the channel over many years, but will have significant beneficial effects. To increase the opportunities for a federal partnership with the U.S. Army Corps of Engineers, the Plan’s recommendations are designed to comply with the Corps’ ecosystem restoration mission requirements, which involve restoring significant ecosystem functions, structure, and dynamic processes that have been degraded. The intent of restoration is to partially or fully reestablish the attributes of a naturalistic, functioning and self-regulating system. A return to historic or pre-development conditions is not mandated at this time.

Restoration goals for the Los Angeles River should be based on the functional value of restored habitat. The Hydrogeomorphic Method (HGM) and the Habitat Evaluation Procedure (HEP) are both commonly used assessments of ecosystem components designed to provide a standardized rating of the health and functioning of habitat types. These assessments generally evaluate the ability of an ecosystem to perform natural functions when compared to “healthy” counterpart systems that are in less-altered conditions. This “functional capacity” is estimated in HGM using several indicators, or variables, related to the overall performance of riparian corridors and wetlands. In the case of HEP analyses, a “suitability index” of key habitat components to support the requirements of selected species of fish and wildlife is identified. These methods offer useful and accepted assessment tools with which to evaluate existing conditions and potential future implementation benefits of proposed restoration measures that will be proposed as a result of the Plan.

Categories of Typical Riverine Wetland Functions

<table>
<thead>
<tr>
<th>Hydrologic</th>
<th>Plant Habitat</th>
<th>Animal Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Maintenance of characteristic channel dynamics</td>
<td>• Maintenance of characteristic plant communities</td>
<td>• Maintenance of spatial structure of habitat</td>
</tr>
<tr>
<td>• Dynamic surface water storage</td>
<td>• Maintenance of characteristic detrital biomass</td>
<td>• Maintenance of interspersion and connectivity</td>
</tr>
<tr>
<td>• Long-term surface water storage</td>
<td></td>
<td>• Maintenance of distribution and abundance of invertebrates</td>
</tr>
<tr>
<td>• Energy dissipation</td>
<td></td>
<td>• Maintenance of distribution and abundance of vertebrates</td>
</tr>
<tr>
<td>• Subsurface water storage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Moderation of groundwater flow or discharge</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Biogeochemical

| • Nutrient cycling                                     | • Detention of imported elements and compounds | • Detention of particulates |
| • Energy dissipation                                    |                                      | • Organic carbon export    |

CONCURRENT PLANNING EFFORTS

A variety of planning efforts have emphasized restoration of the River’s health. These include:

- The “Los Angeles River Master Plan Landscaping Guidelines and Plant Palettes,” completed in 2004, which provides detailed guidance for planting in the River right-of-way using native plant communities that are sustainable within the water regime available, to achieve areas for foraging, roosting and nesting habitats. Native landscaping associated with the LARRMP would greatly enhance the possibilities of habitat creation and mimic the natural communities that once lined the Los Angeles River. Proposals in this Plan conform to these Guidelines.
- The 1996 County Master Plan emphasizes habitat creation, high-potential restoration projects (for example, at Sepulveda Basin and Taylor Yard), and further study of River bird life and habitat requirements.
- The Tujunga Watershed Management Plan includes proposals for extensive restoration.
Indicators that are typically used in the HGM to estimate the hydrologic, biogeochemical and biologic functional capacity of riverine wetlands are listed in the table on the previous page.

For example, an assessment of the functional capacity of riverine habitat to provide natural hydrologic processes may consider the following attributes:

- Alterations of the hydro-regime
- Sediment delivery
- Subsurface flow
- Surface water connectivity
- Surface water persistence
- Channel and floodplain flows

Similarly, the functional ability of an area to “maintain characteristic plant communities” could evaluate the following attributes:

- Age distribution of vegetation
- Amount of contiguous vegetation
- Balance of saplings, shrubs, and trees
- Ratio of native to non-native vegetation

And, habitat elements that benefit steelhead trout could be evaluated for:

- Water temperature during migration periods
- Percentage of pools for refuge and rest during migration
- Canopy cover for temperature moderation and insect input
- Vegetation composition of the riparian zone for food production
- Predominant substrate size

It is recommended that all available in-channel acreage and out-of-channel open space be evaluated for potential habitat value when determining restoration benefits that will accrue from implementing the Revitalization Master Plan. Functional assessments during feasibility phase planning can help identify the optimal balance of the following ecotypes along the Los Angeles River:

- Riverine habitat
- Wetland habitat
- Water quality wetland habitat
- Native habitat for greenways and street BMPs
- Native habitat for street greening
- Native habitat for parkland

Recommendation #4.13: Create a continuous functional riparian corridor that provides habitat for birds, mammals, amphibians, reptiles, invertebrates, and fish within the channel bottom.

Though it may take several generations to implement, this Plan seeks to restore a functional, continuous riparian corridor along the channel bottom as habitat for birds, mammals, and perhaps fish. This will require significant reductions in flow velocities, as well as increased capacity within the channel, to accommodate riparian vegetation. More land will be needed for peak flood storage outside the channel, and greater capacity will be necessary through channel widening or additional box culverts. Implementation of the Plan’s recommendations ultimately will require a combination of these strategies.

Four types of locations should be considered as significant areas for restoration: the channel bottom and terraced side-slopes; natural areas at confluences of major tributaries which could provide opportunities for connectivity upstream with habitat along the tributaries; existing publicly-owned lands located on the River channel, including natural areas such as the Sepulveda Basin or City-owned park spaces; and finally, City-owned property adjacent to the River corridor that might be restored as habitat. These potential locations are illustrated on the map on page 4-18. Efforts should ideally be concentrated on restoration of alluvial fan scrub and riparian woodland as these habitat types have been almost completely lost due to channelization and urbanization. Where feasible, a gradient of habitat types, from riparian to upland, should be created.

The images on the following page illustrate the ways additional riparian habitat and native area buffers might be introduced into the channel corridor, and how they might interface with water quality treatment terraces and recreational amenities. To maximize habitat value, habitat zones should be well-buffered from active recreation zones, and in selected areas, public access may be limited seasonally or geographically. The discussion of the Opportunity Areas that follows describes how habitat zones might be integrated into designs for these areas. Continued observation of the reintroduced riparian elements will provide a better understanding of requirements for survival, given the hydrologic challenges posed by the River.
Recommendation #4.14: Connect this corridor to other significant habitat and migration routes along the tributaries and into the mountains.
This riparian corridor can be reconnected to other significant habitat areas in the surrounding mountains through a focus on improving conditions in the tributaries. While the tributaries themselves are beyond the scope of the Plan, follow-up studies are recommended that would develop a more integrated comprehensive strategy for strengthening ecological connections between the River and its tributaries.

Recommendation #4.15: Improve water quality and provide fish passages, ladders, and riffle pools that would support desirable fish species, including steelhead trout if feasible.
Restoration of fish habitat -- for steelhead trout or other suitable species -- is also a long-term goal that compliments restoration of the riparian corridor. Improvements must be made to the entire River corridor -- from the ocean to the headwaters -- to ensure successful steelhead trout spawning. This Plan recommends that, as plans are developed to rework the channel bottom, habitat for desirable fish species are incorporated into the design.

Recommendation #4.16: Bio-engineer the River’s edge where feasible to create and restore wildlife habitat along the upper reaches of the River.
This recommendation works outward from the channel bottom and focuses on restoring a more naturalized River edge. As with other improvements, reductions in flow velocities and increases in River capacity will be necessary to enable removal of the concrete “armor” and naturalization of the bank edges. In this respect, the Opportunity Areas -- especially Canoga Park, River Glen, and Taylor Yard, where significant bank naturalization is proposed -- will enable a better understanding of what is feasible and under what conditions.

• The Santa Monica Mountains Conservancy is exploring the possibility of establishing the Los Angeles River as an urban wildlife refuge. This long-term proposal, articulated in its report, “The Los Angeles River Urban Wildlife Refuge: A Vision for Parks, Habitat and Urban Runoff,” would require the purchase of numerous parcels of land—both large and small. The refuge would be a flyway for migratory birds, provide year-round habitat for local species, and link habitat within the watershed. The intent of this proposal is compatible with the long-term goals of the Revitalization Master Plan.
• The City of Los Angeles’ Recreation and Parks Department is developing a Master Plan for Griffith Park. A draft is now under review.
• The Natural Community Conservation Planning (NCCP) program of the Department of Fish and Game is a collaborative, multidisciplinary effort by the State of California, and numerous private and public partners that takes a broad-based ecosystem approach to planning for the protection and perpetuation of biological diversity. The primary objective of the NCCP program is to conserve natural communities at the ecosystem scale while accommodating compatible land use. Many California communities, including San Diego, have used this program to facilitate species reintroduction.
WHAT IS ADAPTIVE MANAGEMENT?
The Plan recommends an “adaptive management” strategy that identifies and completes selected pilot projects, and uses them to identify adjustments in design approach and strategy. Through testing and refining, the City and its partners will be better able to achieve long-term goals of ecosystem restoration and River revitalization.

MANAGEMENT AND MAINTENANCE CONSIDERATIONS

MAINTENANCE AND MANAGEMENT NEEDS
Both near- and long-term River revitalization improvements will result in increased maintenance requirements and costs, such as:

- Maintenance and management of vegetation installed within the channel, including thinning and removing non-native or invasive species;
- Maintenance associated with installation and increased use of recreational facilities within the right-of-way; and
- Clean-up due to scour and/or conveyance of debris washed out during flood events.

As more detailed designs for channel improvements and restoration are developed, estimates will be needed for requirements and costs related to ongoing maintenance and capital repair and replacement.

The Joint Powers Authority (JPA), described in more detail in Chapter Nine, is expected to be the primary entity with the authority and responsibility for overseeing maintenance and capital projects within the River right-of-way. The JPA would include both the City and the County, with the U.S. Army Corps of Engineers participating through a Memorandum of Understanding. This entity is envisioned as being responsible for River right-of-way management and maintenance, including public improvements such as trails, access points, concrete and plant maintenance, low-flow channel maintenance, habitat maintenance, monitoring, public safety and policing of the right-of-way. This entity would also be responsible for phased project development, including design, funding, and implementation of channel and bridge modifications, water quality improvements, and ecosystem restoration within the River right-of-way.

RECOMMENDATIONS FOR DESIGNING IMPROVEMENTS TO MINIMIZE MAINTENANCE
To ensure that near- and long-term maintenance does not become a burden for the City and its partners, this Plan recommends a number of design guidelines and an “adaptive management” strategy for introducing improvements that would enable learning from experience. The guidelines include:

1) Reduce flows within the River to a sub-critical, 12 feet per second or less velocity to allow plants to become established. Flow velocities in the existing soft-bottom sections of the River approximate this level. Attempting to introduce vegetation within higher flow regimes likely would result in additional maintenance from more frequent washouts. Reducing flows to a sub-critical level is not expected to avoid beneficial scouring within the channel that would result from significant flooding. As a precautionary measure, on a site-by-site basis, an armoring system would be implemented that anchors the plants or uses slope stabilizers such as geotextile fabric.

2) Vegetation should only be introduced where it does not overly constrain flood capacity and only at levels that represent an acceptable level of maintenance risk for vegetation washout. This would generally favor vegetation on the Riverbank at no lower than the 50-year flood elevation. Design will require additional study with consideration of factors including: flow velocity, channel design, how often channel vegetation would be subject to high water based on past history, type of vegetation, maintenance costs, and other parameters.

Because many of the terracing features recommended in this chapter are nontraditional, physical models will also be required during subsequent design phases to analyze hydraulics and refine the design.

3) Continue maintenance access at the top of the bank, either as a dedicated maintenance access where one exists, or through a parallel public right-of-way, as “top-down” channel improvements are introduced. Any ramps and paths introduced in the channel will be designed to carry the weight of maintenance vehicles and to conform to ADA access requirements. Subsequent design efforts will need to assess maintenance access reach-by-reach, considering flood stage and velocities.