Appendix N: U.S. Fish and Wildlife Service (USFWS) Coordination Act Report (CAR)

Summary

The U.S. Army Corps of Engineers (Corps) has coordinated with the U.S. Fish and Wildlife Service (USFWS) on the Los Angeles River (LAR) Ecosystem Restoration Feasibility Study throughout the planning process. USFWS participated in the project’s stakeholder charettes in December 2009 and throughout the Habitat Evaluation (CHAP) process.

The Corps also coordinated with USFWS per the Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. 703, et seq.), which provides the authority for involvement of the USFWS in evaluating impacts to fish and wildlife from proposed water resource development projects. Federal agencies undertaking water projects are required to fully consider recommendations made by the USFWS regarding the conservation, maintenance, and management of wildlife resources and habitat, which are provided in a Coordination Act Report (CAR) or Planning Aid Letter (PAL). For this project, USFWS was funded to prepare a CAR.

USFWS provided preliminary CAR recommendations on the project in November 2013, and the Draft CAR was submitted to the Corps in January 2014. The Corps coordinated with USFWS during development of the CAR from November 2013 to January 2015. The Corps met with USFWS regarding the CAR recommendations on September 29, 2014 and on October 30, 2014. The Corps fully considered the CAR recommendations and committed to continued coordination with USFWS during the detailed design phase of the project. The Corps received the revised Final CAR on January 5, 2015. The CAR and the Corps’ responses to the CAR’s recommendations are included in this Appendix N.

The Corps will continue coordination with USFWS regarding the CAR recommendations and ways to improve project designs for fish and wildlife resources.
The following documents the specific recommendations from the U.S. Fish and Wildlife Service’s (USFWS) Coordination Act Report (CAR) and the Corps’ responses to these recommendations. The Corps has coordinated with USFWS throughout development of this CAR. The complete CAR is included in this Appendix N.

RECOMMENDATIONS SUMMARY

The FWCA states that “…wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs through the effectual and harmonious planning, development, maintenance, and coordination of wildlife conservation.” With the following recommendations we are suggesting “…measures that should be adopted to prevent the loss of or damage to …wildlife resources, as well as to provide concurrently for the development and improvement of such resources.”

Available funding for fish and wildlife conservation is sparse and usually competitive, normally limiting related actions. Expending conservation resources in areas of high human density is quite costly and often considered less likely to succeed. Yet, coastal southern California contains a large fraction of endemic at-risk species and (now) rare ecosystems, as well as the state's three largest metropolitan regions. As such, understanding the context and capacity to enhance, restore, conserve, and access ecosystems and native fish and wildlife species within this highly urbanized coastal region is a conservation/societal priority. The values of partially restoring and enhancing the ecosystems of the River are greater than the potential biological conservation benefits alone.

As outlined below, we generally suggest that the designs for proposed Project be developed with a stronger focus on principles of restoration of stream natural communities and processes. We understand that the Study Area is within a heavily populated urban area, and we acknowledge that the varied constraints to ecological restoration of the River are tremendous; we are also well aware that the Project design selected cannot increase flood risks.

Based on our Project discussions, the Corps appears to define partial ecological restoration as improvements in habitats or ecological functions. As we have noted above, we expect that full or partial restoration also includes a self-sustaining component as essential to the definition of restoration, even in highly constrained project areas. This is more than semantics, due to the considerable number of restoration projects continuing to be developed and reviewed by our agencies; it is important that we understand each of our respective definitions. While ecological improvements and benefits such as artificial enhancements are highly important and valuable in many areas, we continue to stress the essential long-term importance of at least partial recovery of self-sustaining ecological functions for restoration projects. For example, this would mean evaluating whether proposed native vegetation in some planting areas would not only survive in the long-term without permanent irrigation, but would it also effectively reproduce and replace itself (or naturally succeed) both over time and following expected disturbances such as periodic flooding events.
In part, the current proposed Project designs (all alternatives) appear substantially compromised by proposed recreational, and aesthetic features, often at the expense of otherwise practicable ecological restoration potential (e.g., restoration of relatively natural complexities of processes, substrates, channel/floodplain forms, and natural communities/habitats in some areas). The current designs in many locations are also heavily compromised by the lack of channel widening; this is understandable given the consistent need to maintain channel flood flow capacity and the surrounding constraints. It is understood that widening the channel and floodplain cannot be practicably accomplished throughout the whole Study Area with the subject Project. The resultant potential for partial restoration of ecological functions in these areas of unwidened channel is quite low.

**RESPONSE TO SUMMARY:**

The Corps appreciates the summary comments from the USFWS and, as has been expressed at meetings between the two agencies, we share the goal of restoring a self-regulating, dynamic ecosystem within the constraints imposed by the existing flood risk management project along this highly urbanized river. Corps restoration guidance supports restoring ecological functions that “mimic, as closely as possible, conditions which would occur in the area in the absence of human changes to the landscape and hydrology” (ER 1105-2-100). As the USFWS has noted, channel widening throughout all project reaches in order to restore ecological functions is constrained by the need to maintain the flow capacity requirements of the existing flood damage reduction project.

Corps planning guidance values the “ability of the restored area to continue to function and produce the desired outputs with a minimum of continuing human intervention” and emphasizes the development of restoration projects, to the extent possible, “in a systems context… in order to improve the potential for long-term survival as self-regulating, functioning systems” (USACE 2000). Corps guidance on ecosystem restoration underscores the importance of restoring structure, function, and dynamic processes that have been degraded, as well as reestablishing attributes of a naturalistic and interconnected systems (EP 1165-2-501; EP 1165-2-502). While a fully functioning ecological system is not achievable in every portion of the project area, the project as a whole meets the Corps’ criteria for ecosystem restoration, in that all features collectively contribute to habitat, function, and ecological connectivity creation and improvement.

As documented in the IFR (Integrated Feasibility Report), the project restores native vegetation, wildlife habitat, and ecosystem functions within each reach at varying levels. Wherever possible with available lands, river widening has been included as a project measure to maximize restoration of natural hydrologic functions and support self-sustaining ecologic functions. Other areas rely on surface flows to support native vegetation on the overbank. The proposed project also supports ecological connectivity between widened areas.
With recent input from USFWS, opportunities for additional connectivity have been identified in reaches 1, 3, and 7. The Corps has committed to further evaluate these areas in the design phase, in partnership with USFWS, to ensure that opportunities for wildlife movement are provided throughout the project area.

The proposed project would restore self-sustaining riverine and riparian functions in widened areas and provide opportunities for both aquatic and terrestrial wildlife foraging, shelter, and movement between widened areas in order to meet the Corps’ criteria for ecosystem restoration.

The Corps disagrees that the project is compromised by recreational and aesthetic features. As required by Corps policy, the project’s Recreation Plan was developed after restoration features were planned and is designed to be compatible with restoration features. Recreation features include passive activities such as hiking, walking, and wildlife viewing. Widened areas supporting restoration of a more natural hydrologic regime such as Taylor Yard and LATC (a.k.a. Piggyback Yard) will also support a limited length of dirt/gravel trails that will not impede hydrologic and ecologic functioning. No features were developed purely for aesthetic improvement.

The Corps has reaffirmed its commitment to the environment by formalizing a set of “Environmental Operating Principles,” which are applicable to all of its decision-making and programs. The principles are described in Engineering Circular 1105-2-404 “Planning Civil Work Projects under the Environmental Operating Principles,” 1 May 2003. The Implementation Guidance for the Corps Environmental Operating Principles defines environmental sustainability as "a synergistic process whereby environmental and economic considerations are effectively balanced through the life cycle of project planning, design, construction, operation and maintenance to improve the quality of life for present and future generations." In accord with this definition, the Corps’ goal is to strive to achieve the appropriate balance between the economic and environmental benefits provided by a project.

The Corps values the close working relationship it has with the USFWS and appreciates the USFWS’s continued willingness to discuss the proposed project and assist with project refinements to maximize restoration potential.

**RECOMMENDATION 1**
We promote the restoration and enhancement of fully functioning and self-sustaining ecosystems, where and to the extent practicable. As we have noted otherwise herein, the River is not restorable to a self-sustaining, full function stream system, even within the proposed widened floodplain areas of the Project, due to the constraints of the Study Area and watershed (e.g., reduced fluvial sediment supply from upstream, modified hydrograph, water quality and temperature, etc.). On the
other hand, substantial enhancement and partial restoration of the River is practicable in respective portions of the Study Area. The proposed Project has good basic goals and objectives in relation to general fish and wildlife resources, though they (combined with the Project description and figures) are currently too vague for us to assess the fundamental ecological functions and values of restoration and enhancement that would be implemented. Pursuant to the current Project goals and objectives (to the extent practicable), we suggest the Project designs be modified to more clearly focus on restoration of substantially more natural function of riverine and riparian natural communities in the Project. The proposed channel/streamside ecological structures and natural communities within the River reaches to be partially restored/widened (e.g., former rail yards) should be designed to be more like similarly situated southern California River reference sites (e.g., less open/slow moving water areas), including designing in greater channel/aquatic and riparian area complexity and utilizing natural community compositions and substrates that support higher sensitive taxa richness. The current proposed designs and descriptions for restoration areas read more like landscaping plans than restoration plans. The objectives, designs, and Project description should indicate enough specificity to allow evaluation of the rough elemental ecological gains that would be made (for example, specify the individual minimum acreage of valley foothill riparian strand, freshwater marsh, etc., that would be created or enhanced in each reach, instead of consistently lumping this information); these data are currently lacking. We commend the integrated multi-project, step-wise approach planned for partial restoration and enhancement of the River that would be hopefully continued with future projects.

**RESPONSE 1:**
As described in previous coordination with USFWS, the objectives as currently defined are appropriate and reflective of the naturally occurring habitat that the project restoration is proposing to achieve. Objectives are described in Section 4.2 of the IFR, with measurable objectives criteria outlined in Section 4.2.2. The final array of alternatives meets these objectives’ criteria based on Corps standards as described in Section 6.2, Tables 6-2 and 6-3. These objectives allow us to optimize conceptual designs to achieve benefits for multiple species within variable urban site conditions and constraints. In the design phase, the next phase in the process, the Corps will elaborate on the current conceptual plans and further delineate the complexities of the proposed habitats. The overall goal of the restoration effort is to restore more natural functioning of riverine and riparian communities in the study area. Especially based on recent discussions with the USFWS, the Corps is confident that the ecological value of the identified habitat types will be maximized.

The Corps has proposed full functioning ecological restoration wherever it can be achieved, which because of the urban context of the study area, occurs primarily in widened areas of the river where properties containing historic floodplain adjacent to the river can be acquired. In planning these features, the Corps strived to use any available lands within and outside the river to provide opportunities for restoration of a more natural hydrologic regime that will support complex, self-sustaining native southern California river habitat. The detailed designs will further describe and
delineate the specific suite and interrelationships of substrates, hydrologic and geomorphic features, and vegetation to be restored in these areas. Most similarly situated southern California rivers, i.e., larger perennial systems, with similar flow and gradient both in the watershed and in southern California, generally also have altered hydrologic and hydraulic functioning. Given the constraints in the study area, the project would not be able to reproduce these altered conditions or mimic reference site responses exactly. However, reference conditions from these other sites could be extrapolated to align with the dynamics of the Los Angeles River through the project area. Reference sites to be considered for detailed design, particularly for design of habitat for Santa Ana sucker and Least Bell’s vireo, may include portions of the Santa Ana River which currently supports target habitats and populations of both species.

The plans provided are at a conceptual level and contain planting plans and habitat configurations for the purposes of restoration; the plans are not appropriate for nor do they contain the specificity of landscape plans. Many of the proposed restoration areas are currently comprised of urban land uses, where concrete will be removed. Since the majority of restored areas are being graded from current urban (often industrial) uses, some amount of planned planting is expected to be needed in the initial stages of restoration, as native vegetation in these areas is currently limited to nonexistent (i.e., limited seed bank for natural recruitment). Active planting and temporary irrigation will initially be required in these areas to begin establishing native vegetation. The plans provided in the report are indicative of the planting to be implemented initially; however, over time, storm events will bring seed material from upstream, actively planted vegetation will establish a new seed bank in the soil, the restored natural hydrologic regime will develop dynamic braided channels will form, and areas denuded through scour or other disturbance are expected to naturally re-establish. Once these processes are reestablished, O&M consisting mainly of invasives removal can be implemented as necessary to support passive restoration in widened areas.

Temporary irrigation will be used to establish restored vegetation in widened and overbank areas, after which vegetation is expected to be self-sustaining, requiring minimal maintenance and relying on groundwater and surface flows to persist. Temporary irrigation will also be used to establish vegetation in the concrete channel walls (e.g., vegetated terraces, vegetation hanging from top of bank). Detailed design will identify all water sources to support the proposed vegetation within the concrete channel walls, including surface flows and runoff that may be redirected to sustain this vegetation and avoid permanent irrigation (See Section 4.4.5 of the Final IFR, measure 4a).

Passive restoration will also be implemented for existing vegetation in the soft bottom portions of the channel where trash and invasives removal will occur. The Final IFR document includes clarifications regarding passive restoration and provisions for natural
hydrologic functioning in widened areas.

Information regarding acreages of habitats created is provided in Table 6-7 of the IFR. Chapter 7 of the IFR describes the Recommended Plan and NER Plan in terms of features restored by reach. The Corps will continue to provide detailed restoration and habitat information during the PED (Pre-Construction Engineering & Design) phase as coordination with USFWS on detailed project features continues.

**RECOMMENDATION 2**

Of the Project alternatives currently proposed, we recommend Alternative 20, with modifications (as noted below). Alternative 20 has the highest potential of the proposed alternatives to restore considerable ecological functions of the River. In order to perform any substantial riverine and riparian restoration or enhancement on the River (and maintain current flood flow capacities for flood risk management), the right-of-way (ROW) and floodplain currently utilized by the River will need to be re-widened in considerable River reaches (as noted in the 2013 EIS/EIR). This is because effective restoration cannot be performed within the confines of the existing channelized River without reducing flood carrying capacity of that same channelized reach (e.g., due to channel “roughness” associated with mature woody vegetation) unless a wider/larger area to carry the same flood flows is provided. As such, truly effective ecological restoration of the River (partial restoration) can only occur in areas of widened River ROW.

We recommend substantive modification of any approved Project alternative to increase the focus of proposed Project resources on practicable levels of restoration of River hydrology and geomorphology. We expect that the current proposed designs (all proposed alternatives), if implemented, would result in improvements, but relatively small native fish and wildlife resource net gains and overall low ecological integrity and function for these species within Project restoration and enhancement areas, due to very important remaining stressors such as: a) resultant low complexities of substrates/geomorphology/hydrology/natural communities; b) large areas of artificial (slow moving low flow) open water and channel; c) high human disturbance near stream banks; d) low cover levels, structure, and diversity (e.g., age classes) of native riparian and riverine vegetation; and e) substantial use of proposed hard structures. These stressors can be reduced with potential Project designs, such as maintenance of relatively natural lotic (flowing water; we suggest less area of still, open water) conditions over the length of the Study Area, but some of these stressor would remain with all practicable designs. Considering the constraints involved, we nevertheless suggest that it is practicable for the designs for Project restoration areas (areas of widened floodplain) to be more “wild” and less “naturalistic”\(^{15}\)/ordered (such as by hard structures and slope protection) than as shown within Project concept drawings and designs.\(^{16}\)

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\(^{15}\) Naturalistic: looking similar to what appears in nature; not looking artificial or man-made. Not necessarily retaining the functional characteristics of natural ecosystems, such as self-sustainability, functional food webs/native species interactions, etc.

\(^{16}\) In email attachment to us dated 25 November 2014, the Corp[s] noted: “The Corps’ intent is that the stressors described will be addressed in widened areas, where increased flood capacity will allow for varied substrates
We suggest that riverine and riparian ecological (partial) restoration be more clearly the primary goal within the specific River reaches to be widened. For instance, most widened floodplain areas should be designed for riparian scrub-woodland-forest communities relatively similar to those that existed historically in the Project reaches, including providing for cyclical and episodic succession of riparian natural community age classes over time following denudation events (floods). Proposed Project designs should rely on utilization of existing groundwater (e.g., less than 6 to 8 ft from the ground surface for riparian natural communities) and natural surface water flows for native vegetation needs (e.g., see Stromberg et al. 1996; Stromberg 1998). Restoration of widened floodplain areas should also be designed with the expectation of some channel form changes over time: large flood events should be allowed to provide some channel re-setting (geomorphic change) action within the necessary outside flood risk management sideboards of widened River reaches.

**RESPONSE 2:**
Alternative 20 is the Locally Preferred Plan (LPP) and the Corps’ recommended plan. The Corps agrees that it has the potential to restore considerable ecological functions of the River.

As outlined in the feasibility study, aquatic ecosystem restoration is the primary goal and the driver for development of all alternatives. Each alternative strives to maximize aquatic and riparian restoration. The Corps has worked closely with the non-Federal sponsor to consider all areas within the project footprint that can be acquired for widening, with Alternative 20 supporting the maximum amount of widening. The Corps has proposed full functioning ecological restoration wherever it can be achieved, which because of the urban context of the study area, occurs primarily in widened areas of the river where properties containing historic floodplain adjacent to the river can be acquired. In planning these features, the Corps strived to use any available lands within and outside the river to provide opportunities for effective restoration of a more natural hydrologic regime that will support complex, self-sustaining native southern California river habitat while maintaining the necessary flood protection. Passive recreation is included where it is compatible with the ecosystem restoration features.

The Corps’ intent is that the stressors described will be addressed in widened areas, and natural hydrology, high vegetative cover and structural diversity, and very limited and well-buried hard structures. Open water areas will be designed to support native fish such as Santa Ana sucker and Arroyo chub, including riffle/pool/glide sequences. Human disturbance is expected to be minimal in widened areas, where recreational dirt trails will be designated. In widened areas, it is expected that the active channel will migrate and change form and that sediments will be redistributed with storm events. Vegetation is expected to be denuded with natural higher flows and velocities, and be re-established naturally. Any grade stabilizers in these areas will be well buried, and not visible from the surface.”
where increased flood capacity will allow for varied substrates and a more natural hydrologic regime, high vegetative cover and structural diversity of historically occurring riparian communities, and very limited and well-buried hard structures. Monitoring of depth to groundwater will be included as part of the Monitoring and Adaptive Management Plan to ensure riparian habitats can persist. Open water areas will be designed suitable to support native fish such as Santa Ana sucker and arroyo chub, including riffle/pool/glide sequences. Human disturbance is expected to be minimal in widened areas, where recreational dirt trails will be designated. In widened areas, it is expected that the active channel will migrate and change form and that sediments will be redistributed with storm events. Vegetation is expected to be denuded with natural episodic higher flows and velocities, and be re-established naturally. Any grade stabilizers in these areas will be limited to those necessary to maintain the integrity of the flood damage reduction project, and are not intended to further constrain the restoration of the aquatic or riparian system. Given the constraints of this highly urbanized system, all stressors may not be entirely removed from the restored areas of the channel; however, high ecological function and integrity sufficient to support these objectives can be achieved.

Alternative 20 will provide large restored widened areas (such as Verdugo Wash, Taylor Yard, and the LATC site) to serve as riparian habitat patches with a more natural hydrologic regime. Vegetation and habitat elements in these widened areas will be restored with the goal to support a large number of territories for various riparian obligate birds, including least Bell’s vireo, yellow warbler, and yellow breasted chat, stop over habitat for migrants, as well as habitat and refugia for amphibians, reptiles, and mammals, including larger carnivores such as coyote and possibly bobcat. River channels in widened areas will be designed to support habitat for Santa Ana sucker and arroyo chub. These restored widened patches will be connected in part via soft bottom reaches 2, 4, 5, and 6 and restored in-channel habitat in Reach 8.

The remaining project areas that are not widened will support varying levels of restored native vegetation and function. In these areas, some of the described stressors may remain due to urban constraints and the requirement to maintain flood conveyance. The Corps is committed to working with USFWS to develop methods during detailed design to reduce any remaining stressors while not compromising the flood risk management function of the channel including channel conveyance.

Movement on a regional scale is expected to be accommodated to Griffith Park via wildlife use of existing equestrian tunnels in Reaches 1 and 4. Recent studies using wildlife cameras indicate tunnels have been used by coyote and deer, with one bobcat sighting. Other species that could use the tunnels, if presence of appropriate habitat were available surrounding them, include raccoons, skunks, and gray foxes. Future opportunity for movement to further open space areas such as the Verdugo and San Gabriel Mountains is provided via restoration of the confluences of the Verdugo Wash.
and Arroyo Seco. Restoration upstream on the remainder of these tributaries is needed via additional projects to complete the connection between the River and these mountainous areas.

In existing hard-bottom reaches 1, 3 and 7, which cannot be widened, opportunities for aquatic connectivity, to maximize restoration potential for aquatic wildlife, will be further evaluated during detailed design. These measures would create in-channel diversity and heterogeneity needed to support passage of wildlife, including aquatic species such as native fish. Such measures may include 1) use of anchored boulders and a new meandering low flow channel in the existing concrete, 2) "speed bumps" perpendicular to flow that can trap sediment and allow small to moderate sized vegetation to grow, and 3) a new v-shaped low flow channel with varying widths and depths. These measures may, in particular, improve passage for aquatic and terrestrial wildlife in Reach 3 from the Verdugo Wash confluence to the upstream edge of the soft bottom Reach 4, and in Reach 7 from the downstream edge of the soft bottom Reach 6 to Arroyo Seco. In addition, terrestrial wildlife may then more easily move from Griffith Park using the equestrian tunnel in Reach 4 upstream to Verdugo Wash or downstream to Arroyo Seco. Additional restoration of these tributaries outside the project area would facilitate further regional movement in the future. This restoration may be accomplished by other federal, state, or local stakeholders.

Specific features for wildlife access will be considered during the detailed design stage, and would depend on the detailed design and hydraulic analysis developed during the detailed design phase, to ensure that they are not in conflict with flood damage reduction and flow conveyance requirements or other constraints on the project. Movement for bobcats will be the standard for design of access, and such designs will be implemented wherever practicable.

Placement of wildlife access measures may include access in Reach 1 from Pollywog Park into the river channel, as practicable. In this area, wildlife access may be achieved through the creation of a slope along the currently vertical bank, as described in measure 3b in Section 4.4.5. Such a design would allow wildlife moving from Griffith Park into the river channel access to the restored Pollywog Park site, which is currently disconnected from the River by a vertical wall. Implementation of specific methods and location of access would be dependent on the detailed hydrologic and hydraulic modeling developed during the design phase.

Considerations for segregation of “spring fed waters” from surface water flows would also be made during the detailed design phase. This segregation would be considered to support refugia for fish, where groundwater would feed the refugia while surface flows might bypass such areas.
The Corps will further evaluate these measures during the design phase, as their implementation or placement is likely to require hydrologic and hydraulic modeling data and/or more detailed design. Prior to implementation of the measures identified, the Corps will assess whether supplemental analysis is required to address new or different effects than those already assessed.

For the project area as a whole, the restoration features provide an overall gain in ecologic function and integrity, as well as connectivity for aquatic and terrestrial species. The Final IFR document includes these clarifications regarding provisions for natural hydrologic functioning in widened areas.

The Corps will develop detailed designs for the widened reaches during the PED phase that will carefully evaluate and consider USFWS recommendations. The Corps will continue to coordinate with USFWS during the PED phase and development of detailed designs to ensure that restoration in widened reaches achieves the maximum level of ecological function, focusing on passive restoration, a more natural hydrologic regime, and more natural geomorphic character. The Corps is committed to restoring the maximum ecological function while meeting flood conveyance requirements.

**RECOMMENDATION 3**

Project recreation/access features involving hard structures should be limited to the outside periphery of widened/restored River stretches (such as Taylor Yard and Piggyback Yard). Many of the design drawings show substantial “hard-scape” recreational features well within widened-reach restoration areas. Limiting recreational structures within the interior of restoration areas would both reduce potential for flood damage/maintenance of expensive structures, and would likely increase the biological function in these widened reaches for native species. The proposed construction of instream and floodplain hard structures that are out of context with naturally functioning systems (e.g., retaining walls, curbs, formal paved or heavily compacted or surfaced paths, boardwalks, grade control structures, etc.) should be minimized within restored areas in widened reaches (Kauffman et al. 1993). Also, such hard structures typically reduce the actual and perceived “wild” nature of areas, reducing the effective nature experience for people (Louv 2012, Cookson 2013). We recognize that recreation enhancement projects within the River should inspire new River “stewards,” who would be fundamental in the protection of these natural systems in the future. As such, we suggest designing “organic” recreation enhancement features.

17 In email attachment to us dated 25 November 2014, the Corp[s] noted: “As required, the Recreation Plan was developed after restoration features were planned. Recreation features include passive activities such as hiking, walking, and wildlife viewing. Widened areas supporting restoration of more natural hydrology such as Taylor Yard and LATC (a.k.a. Piggyback Yard) will support a limited length of dirt/gravel trails that will not impede hydrologic and ecologic functioning. Recreation structures such as restrooms and parking lots will be limited to the outside edges of widened areas and along overbank recreation trails. New trails throughout the project area will be unpaved, and certain currently paved access roads will be converted to dirt/gravel.”
that instill “adventure” and “challenge,” in part through subtle engineering solutions that accommodate River recreation without degrading development of natural River ecosystem features and functions (e.g., see Borgman 1995). Pursuant to our Connecting People with Nature policies, we suggest that Project designs be modified with a greater emphasis on restoration of (and access to) the “wildness” of the River within these widened reaches, to the fullest extent practicable. Compared to current designs, such restoration would likely result in higher abundance of native fish and wildlife and greater levels of native biodiversity, with resultant enhanced opportunities for uncommon wildlife observation and nature experiences.  

**RESPONSE 3:**  
As documented in previous coordination and as referenced in footnote 17, recreation features are proposed for passive activities such as hiking, walking, and wildlife viewing where they will not conflict with the restored habitat. Widened areas supporting restoration of a more natural hydrologic regime such as Taylor Yard and LATC will support a limited length of dirt/gravel trails that will not impede hydrologic and ecologic functioning. Hard structures such as restrooms and parking lots will be limited to the outside edges of widened areas. 

The Recreation Analysis in Appendix B (Economics) of the IFR showed a restroom located in the middle of the LATC site. This restroom has been moved to the edge of the site in the Final IFR to be consistent with Corps policy. Section 4.16, Recreation Plan, of the IFR also has been revised to further emphasize that recreation features are designed after restoration features are planned, and per Corps policy must be compatible with the restoration function.

The Corps will continue to coordinate with USFWS during the development of detailed designs (PED) to ensure that recreation features are designed and implemented compatible with restoration. The Corps will ensure that the passive recreational use is compatible with the more in depth design of restoration features. 

**RECOMMENDATION 4**  
Similar to our suggestions regarding Project recreation structures above, we suggest that the potential ecological interactions between the riparian and aquatic ecosystems be reflected more fully in the Project restoration and flood damage reduction features proposed. We suggest minimization of instream flow-control hard structures and unburied hard stream bank slope protection in widened reaches, particularly along the riverine-riparian interface. These features often result in severed linkages between aquatic and riparian ecosystems (Kauffman et al. 1997). Any new essential instream and riparian hard-structure features (e.g., flow control and retaining walls, culverts, etc.) should be naturally complex (e.g., buried rock instead of surface concrete

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where practicable), accelerate riparian recovery, and imitate natural processes and functions
(Kauffman et al. 1997). While acknowledging the context of the Study Area, the hydrology
designs for widened River reaches to be restored (such as Taylor Yard and Piggyback Yard)
should accommodate, to the maximum extent practicable, the dynamic and episodic nature of
surface low and high River flows and the fluvial processes that were natural to the River,
including water inlet and outlet structures that provide for a relatively natural high-flow
hydrograph to newly created riparian areas. Restoration designs for low-flow channel paths and
water inlet/outlet structures for widened reaches should emulate the full range of natural flow
events and groundwater levels that original riverine and riparian terrace natural communities were
subJECTED to before development. Restoration designs should reflect and emulate the fact that
the natural River channel and riparian zones were (historically) dynamic both spatially and
temporally, and that episodic denudation flood flows are natural and necessary to riparian integrity
(e.g., cycling of seral stages) in the Study Area.

While we understand the major design constraints of the Project area, we suggest that the current
proposed Project designs (even though an improvement over existing conditions) would retain
many of the existing rather simplified (“naturalistic”) features of the River
in widened/restored areas. These reaches of low natural heterogeneity, as designed, would
have continuing negative influences on local channel hydrodynamics, channel morphology,
and native stream bank surface cover and function for native species. As such, these features
would likely have long-term detrimental influences on important riparian/aquatic interactions
by reducing shade over water, stream nutrient inputs, and woody debris inputs, and ecosystem
productivity would not meet its full potential.

The riverine and riparian ecosystems that are expected to be at least partially restored by the
proposed Project are episodic disturbance oriented/dependent ecosystems. As such, in areas where
the River would be substantially widened, we suggest that Project designs should not intend to
fully “lock” the low-flow channel in one place, but instead should allow for some limited amount
of channel migration over time between the “sideboards” otherwise necessary for flood damage
reduction capacities (in the heavily constrained context of the Project area). Almost all restored
floodplain terrace ground surfaces should be well within the distances to groundwater that can be
utilized naturally by the expected native riparian vegetation and designed for appropriate episodic
succession- setting flooding events necessary to sustain the target natural communities (e.g.,
willow-cottonwood woodland) and habitats (e.g., vireo habitat) in the long-term, with no reliance
on periodic replanting for replacement recruitment. 19

19 In email attachment to us dated 25 November 2014, the Corp[s] noted: “…the Corps’ intent is that that widened areas
will support high levels of heterogeneity. The active channel will migrate and change form and terraces and sediments
will be redistributed with storm events. Initial grading during construction of widened areas will be heterogeneous and
diverse topography will be created. The dynamic and episodic nature of the River flows will be accommodated in
these areas, allowing the River to carve new channel configurations over time. Vegetation is expected to be denuded
with natural higher flows and velocities, and be re-established naturally. Any grade stabilizers in these areas will be
well buried perpendicular to flows, and not visible from the surface. Once initially planted and a seed bank
established, passive recovery will be the method for re-vegetation after flood events. Such natural hydrologic
RESPONSE 4:
As outlined in previous coordination and as documented in your footnote 19, under Alternative 20, we agree that the widened areas should be designed to support high levels of heterogeneity, and the existing plan provides for that. The active channel will be allowed to migrate and change form, and terraces and sediments will be redistributed with storm events. Initial grading during construction of widened areas will create diverse topography. The dynamic and episodic nature of the River flows will be accommodated in these areas, allowing the River to carve new channel configurations over time, creating the complexities of a natural river system.

Vegetation is expected to be denuded with natural higher flows and velocities, and be re-established naturally. Any grade stabilizers in these areas will be well buried perpendicular to flows, and not visible from the surface. Once initially planted and a seed bank established, passive recovery will be the method for re-vegetation after flood events. Such natural hydrologic functions would support riparian/aquatic interactions by providing habitat elements including shade over water, and stream nutrient and woody debris inputs. The Final IFR document includes these clarifications regarding provisions for natural hydrologic functioning.

As described in Response 1, temporary irrigation will be used to establish restored vegetation in widened and overbank areas, after which vegetation is expected to be self-sustaining, requiring minimal maintenance and relying on groundwater and surface flows to persist. Detailed design will identify all water sources to support the proposed vegetation. Monitoring of depth to groundwater will be included as part of the Monitoring and Adaptive Management Plan to ensure riparian habitats can persist. Active planting and temporary irrigation will initially be required in these areas to begin establishing native vegetation. The plans provided in the report are indicative of the planting to be implemented initially; however, over time, storm events will bring seed material from upstream, actively planted vegetation will establish a new seed bank in the soil, a restored natural hydrologic regime will develop dynamic channel forms, and areas denuded through scour or other disturbance are expected to naturally re-establish.

The Corps will continue to coordinate with USFWS during the development of detailed designs to ensure that restoration in widened reaches mimics a natural hydrologic regime and fluvial processes to the extent possible, allowing for channel migration and reworking of restored widened areas following flood events, while not compromising existing levels of flood protection. Flood damage reduction features are not proposed as part of this project. Additional H&H (hydrology and hydraulics) modeling will be conducted during the detailed design phase to inform design refinements that will
achieve a sustainable balance between flood damage reduction and natural hydrologic functioning.

**RECOMMENDATION 5**
Within the Project portions of the River that would not be widened by the proposed Project, we suggest that ecological enhancement, native landscaping, recreation, buffer, and/or stream water shading be the stated goals for and focus of Project activities in most of these areas. While providing some ecological improvement, we suggest that these features be treated as ecological enhancement because the substantial constraints in these reaches preclude self-sustaining full or partial restoration of most of the important riverine or riparian ecological functions of the River. Expectations of substantial occupation or connectivity use by typical target native species in portions of the River that would not be widened should be low, with the exceptions of any implementation of specific artificial enhancements (such as developed artificial snags, nesting cavities and shelves, and riverine hardscape pools and riffles). Establishment of native trees on the south side of the River where water shading can be accomplished would enhance stream water temperature reductions that may help provide for limited use of other Project areas by native fish. We find this distinction between restoration and enhancement to be important due to the precedent this could set for ecological restoration within other projects.

**RESPONSE 5:***
The project provides native vegetation, wildlife habitat, and ecosystem functions within each reach at varying levels, within existing constraints. Each project feature is designed for restoration benefit. The Corps recognizes that in some cases the possible features are highly constrained by the need to maintain flood conveyance or to work within existing major infrastructure constraints such as freeways, railroad, and residential uses.

The proposed project maximizes ecological restoration where it can be achieved, primarily in widened areas of the river where floodplain property adjacent to the river can be acquired. In other portions of the project area, the Corps has planned for construction of features that would improve value for wildlife in the vicinity and for connectivity between restored widened areas. Constrained areas planted with native vegetation still provide opportunities for foraging and shelter, as well as cover for movement, and contribute value to the project as a whole, especially when considering the complex limitations afforded by the urban landscape.

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20 In email attachment to us dated 25 November 2014, the Corp[s] noted: “The Corps disagrees that individual project features should be parsed out as “restoration” vs. “landscaping” vs. “greening”. While the definition of “restoration” as provided by USFWS is not achievable in every portion of the project area, the project as a whole meets the Corps’ criteria for ecosystem restoration, in that all features collectively contribute to habitat and connectivity creation and improvement throughout the project area. In this way, wildlife is provided new large areas (e.g. 35+ acre sites such as Verdugo Wash, Taylor Yard, and LATC (a.k.a. Piggyback Yard)) of restored habitat with a means to move between them, as well as into other surrounding natural areas.”
As documented in your footnote 20, the Corps disagrees that individual project features should be parsed out as restoration versus enhancement. While the definition of “restoration” as provided by USFWS is not achievable in every portion of the project area, the project as a whole meets the Corps’ criteria for ecosystem restoration, in that all features collectively contribute to habitat and connectivity restoration and improvement throughout the project area. In this way, wildlife is provided new large areas (e.g. 35+ acre sites such as Verdugo Wash, Taylor Yard, and LATC) of restored habitat with a means to move between them, as well as into other surrounding natural areas. A description of potential features to accommodate such movement is provided above in the response to Recommendation 2.

Restoration of habitat and wildlife movement at a more regional level is expected to be a collaborative effort, whereby other federal, state, and local agencies and stakeholders have expressed interest in contributing to meet restoration goals along the LA River, within the watershed, and in surrounding natural areas. Restoration associated with this project as a whole has been considered by many local NGOs as the backbone of future restoration efforts that may be undertaken by others to improve other portions of the river and tributaries.

RECOMMENDATION 6
We suggest that the Project ecological guidelines and designs for restoration be based on typical restoration ecology\(^{21}\) science and terminology, and less on landscape architecture\(^{22}\) science and terminology. Baseline and post-Project implementation surveys/assessments for fish, amphibians, reptiles, and the associated parameters of potential habitats for target species should be performed in the Study Area. Non-native species with considerable potential to adversely affect Project restoration success should also be assessed, including potential source populations in the watershed.

The following water quality parameters of specific Project reaches should be evaluated and mapped as part of Project planning and implementation: water temperature, dissolved oxygen, pH, conductivity, turbidity, substrates, water velocities, channel forms (e.g., deep or exotic predator-free pools), flood refugia and back-channel areas, woody debris and leaf litter. These parameters and natural community mapping should be analyzed relative to current non-native fish, amphibian, and reptile occupation of the Study Area. These parameters should then be compared to known ideal (and minimum) necessary natural parameters and conditions of habitats normally

\(^{21}\) Restoration ecology: the scientific study of repairing disturbed ecosystems through human intervention. Ecological restoration implementation aims to recreate, initiate, or accelerate the recovery of an ecosystem that has been disturbed.

\(^{22}\) Landscape architecture: the art and practice of designing the outdoor environment, especially designing parks or gardens together with buildings and roads.
utilized by species such as Santa Ana sucker, arroyo chub, two-striped garter snake, California toad, Baja California tree frog, and other appropriate restoration indicator and surrogate/umbrella species. This survey information should be used to inform basic Project design development (e.g., to provide functional habitats for specific native fish and aquatic wildlife species), as well as post-construction adaptive management decisions, and future restoration projects in the watershed.23

RESPONSE 6:
As described in the above Response to Summary and Response 1, the Corps ecosystem restoration guidance and policy followed by this study is grounded in restoration science and terminology; recreation features are designed after restoration plans are in place, are designed to be compatible with restoration plans, and utilize standard landscape architecture principles. As described in previous coordination and as documented in your footnote 23, the Monitoring and Adaptive Management Plan (MAMP) included in Appendix H of the Final IFR includes restoration monitoring to evaluate the performance of restoration actions. As described in Section 5.5.4 of the Final IFR, pre-construction surveys would be performed for least Bell’s vireo and for special status plant and wildlife species, and the Corps would continue to coordinate with the USFWS throughout the design and construction period. Monitoring includes an inventory of wildlife species based on observations of wildlife and signs of usage, mapping of habitat, as well as inventory of habitat elements present within the project footprint.

Monitoring of riparian, marsh, and fish habitat is outlined in the MAMP, which evaluates various habitat parameters including, but not limited to, invasive plants, hydrology, soils, sedimentation, water quality, in-stream structure, and also includes bird, fish, and amphibian species surveys. The water quality parameters suggested in this recommendation will be monitored as part of the MAMP. These habitat parameters can be compared to reference conditions, as suggested in Response 1, to inform adaptive management decisions and direct restoration actions. The MAMP includes a list of target species in order to direct restoration of habitat elements in

23 In email attachment to us dated 25 November 2014, the Corp[s] commented: “The Monitoring and Adaptive Management Plan (MAMP) to be included in the Final IFR document includes pre- and post- restoration monitoring to evaluate the performance of restoration actions. Habitat evaluations will be performed as restoration progresses to assess habitat values of restored features and inform adaptive management decisions. These evaluations require an inventory of wildlife species based on observations of wildlife and signs of usage, mapping of habitat, as well as inventory of habitat elements present within the project footprint. Monitoring of riparian, marsh, and fish habitat is outlined in the MAMP, which evaluates various habitat parameters including, but not limited to, invasive plants, hydrology, soils, sedimentation, water quality, in-stream structure, and also includes bird, fish, and amphibian species surveys. These habitat parameters can be compared to ideal reference conditions to inform adaptive management decisions and direct restoration actions. The MAMP will be revised to include a list of target species in order to direct restoration of habitat elements in ways that would benefit the life history requirements of those species.”
ways that would benefit the life history requirements of those species.

Non-native plant species will also be removed as part of construction and managed as part of operation and maintenance of the project. Removal of non-native wildlife could be performed by resource agencies or other interested entities separate from this project. If a removal program were to be proposed, the Corps and non-Federal sponsor would coordinate with the proponent and the agencies with jurisdiction over such removals to ensure compatibility of the program with the restoration project, including project operation and maintenance.

The Corps will coordinate further with the USFWS and other resource agencies during the detailed design phase to identify any additional parameters or methodologies that may be appropriate in specific locations or circumstances.

**RECOMMENDATION 7**

In relation to the needs of any of the seven native fish that could potentially be re-established in the River (such as arroyo chub), the proposed Project as currently designed would appear to: a) lack necessary complexity of habitats; b) lack necessary substrates and channel forms, including refugia; c) provide low food availability; d) be subject to excessive water temperatures; e) have an overabundance of large areas of open water; and f) provide/retain competitive advantage for exotic fish species over native species. The Project ecological restoration designs should provide higher priority to creating the natural parameters and conditions needed for the restoration of at least one specific native fish species, to the extent practicable, so as to both support their basic survival and to give them competitive advantages over exotic species that would likely continue to occupy the Study Area following Project implementation (e.g., see Moyle and Light 1996). Assessments of whether proposed Project designs would likely provide these specific natural conditions for target species, including expectations of associated non-native species competition, should be provided before Project designs are developed further.²⁴

**RESPONSE 7:**

As described in our previous discussions (and documented in your footnote 24), the design drawings at the feasibility level are conceptual and will be revised and refined during the detailed design stage to include the necessary parameters that

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²⁴ In email attachment to us dated 25 November 2014, the Corp[s] commented: “The design drawings at the feasibility level are conceptual, and will be revised and refined during the detailed design stage to include the necessary parameters that would support native fish habitat in widened areas and in overbank areas during the detailed design phase. In concrete reaches, where features are more limited by maintenance of flood capacity, designs will focus on providing refugia and passage. As discussed with USFWS, designs will focus on providing the hydrology, substrates, and habitat elements required by Arroyo chub and Santa Ana sucker. In the Draft IFR, in Section 4.2.2, Santa Ana sucker are identified as a target for restoration of native fish habitat. Other target fish species for restoration as well as their general requirements will be clarified in the Final IFR document.”
would support native fish habitat in widened areas and in overbank areas during the
detailed design phase. In concrete reaches, where features are more limited by
maintenance of flood capacity, designs will focus on providing refugia and passage.

As discussed with USFWS, designs will focus on providing the hydrologic regime,
substrates, and habitat elements required by arroyo chub and Santa Ana sucker. In
the IFR, in Section 4.2.2, Santa Ana sucker are identified as a target for restoration
of native fish habitat. Other target fish species for restoration as well as their general
requirements are clarified in the Final IFR document. The Corps will continue to
coordinate with USFWS during the development of detailed designs to ensure that
the appropriate habitat parameters and design elements are captured.

Text added to the IFR includes the following:

“In widened areas, restored river channels will be designed to support habitat for
native fish including arroyo chub and Santa Ana sucker, and provide the
necessary constituent elements including but not limited to water shaded by
riparian vegetation, riffle/run/pool/glide sequences and refugia, in channel
woody debris, gravel and cobble substrates.”

“In existing hard-bottom reaches 1, 3 and 7, which cannot be widened,
opportunities for aquatic connectivity, to maximize restoration potential for
aquatic wildlife, will be further evaluated during detailed design. These
measures would create in-channel diversity and heterogeneity needed to support
passage of wildlife, including aquatic species such as native fish. Such measures
may include 1) use of anchored boulders and a new meandering low flow
channel in the existing concrete, 2) ”speed bumps” perpendicular to flow that can
trap sediment and allow small to moderate sized vegetation to grow, and 3) a
new v-shaped low flow channel with varying widths and depths. Implementation
of these measures would depend on the detailed design and hydraulic analysis
developed during the detailed design phase, to ensure that they are not in conflict
with flow conveyance requirements or other constraints on the project.”

**RECOMMENDATION 8**

In our opinion, the various alternatives proposed would provide limited restored functions for
typical stream restoration target species. Considering the heavy constraints of the Study Area,
some excellent opportunities exist for artificial enhancement measures, particularly where
restoration is not practicable. Additionally, these types of features (e.g., large hollow snags, tall
steep river banks) are not likely to otherwise develop in the short-term or over time in significant
number/area within the Study Area due to the limited floodplain widths and modified hydrology in
even the widest proposed restoration sites of the Project. The directed artificial measures suggested
below would likely be substantially and quickly utilized by some uncommon or sensitive bird and
bat species and could provide very attractive and important watchable wildlife opportunities along the River for residents and visitors. These features could be effectively incorporated into many otherwise heavily constrained channel reaches and off-channel adjacent areas that otherwise lack the space to support aquatic or riparian restoration features (such as artificial features added to walls, bridges, and other hard structures). These include: provision of various nest cavities and structures (e.g., for wood duck, barn owl, osprey, tree swallow, white-throated swifts, and western bluebird) such as nest holes/crevices created in/on new and existing hard structures, and nest platforms/shelves/boxes; placed/erected large hollow snags and suitable vertical shafts with heavy inside texture (e.g., swifts); and creation of artificial large steep sandy/earth banks (e.g., northern rough-winged swallow and belted kingfisher; note that these supported banks could functionally occur along channel tops in some areas, without affecting flood conveyance). Directed artificial enhancement measures for some local bat species (e.g., Yuma myotis, western pipistrelle, Mexican free-tailed bat, and big brown bat) should include increasing availability of roosts in the Project area by providing large hollow vertical snags and shafts, rock outcrops, bat boxes, and artificial roost cavities designed into new hard structures. Almost all of these artificial features would require some limited periodic maintenance or replacement.

RESPONSE 8:
The design drawings at the feasibility level are conceptual, and are revised and refined during the detailed design stage. Installation of artificial habitat features as recommended could be considered in the detailed design stage in coordination with USFWS, as practicable in relation to meeting project objectives.

The Final IFR will include additional text as follows clarifying the inclusion of such directed restoration measures.

“Other design features specific to certain species may be incorporated in the detailed design phase and accommodated where practicable and appropriate. It is expected that while these features could potentially be installed artificially during restoration activities, many of these features will also evolve naturally over time as vegetation matures and natural hydrologic forces continue to shape the hydrologic regime of widened areas. These features may include, but are not limited to, artificial nest cavities (which could be used by wood duck, barn owl, tree swallow, and western bluebird among other species), large hollow snags (used by swifts), and artificial steep sandy banks (used by northern rough-winged swallow and belted kingfisher).”

RECOMMENDATION 9
Brown-headed cowbird occupation of the Study Area should be assessed during Project planning, including potential source populations in the region within several miles. Cowbird feeding areas (e.g., outdoor human feeding areas, stables and other equestrian facilities, and some turf zones) should be reduced or modified in the Project general region, to the extent practicable. If brown-
headed cowbird parasitism levels are still likely to be problematic for sensitive birds potentially occurring within the Project area, then management of cowbird numbers should be performed by the Project for the life of the Project, such as through trapping at local horse stables and other cowbird source or breeding areas, with standard cowbird traps. We recommend a long-term management strategy for cowbirds be developed by the City and Corps for the lowland region of the River.

**RESPONSE 9:**
Corps guidance on ecosystem restoration directs the Corps to focus on restoring structure, function, and dynamic processes of habitats that have been degraded (EP 1165-2-501; EP 1165-2-502). Focus on presence of particular species of wildlife, and absence of undesirable wildlife species, is expected to be within the jurisdiction of wildlife resource agencies or local entities. General wildlife surveys are included as part of monitoring in the Monitoring and Adaptive Management Plan. If surveys document a large population of cowbirds in the project area, as well as the presence of vireo, the Corps would inform the Adaptive Management Team member agencies, one or more of which may implement a removal program separate from the restoration project or identify other entities interested in doing so. If a removal program were to be proposed, the Corps and non-Federal sponsor would coordinate with the proponent and the agencies with jurisdiction over such removals to ensure compatibility of the program with the restoration project, including project operation and maintenance.

**RECOMMENDATION 10**
Restoration of basic natural stream features is a highly important first design step in the re-establishment of any of the native fish to the River (e.g., channel substrates, water quality/flow, channel configuration/complexity). Nevertheless, many of the factors affecting the current extirpation of most native fish in the River extend well beyond the riparian/stream ecotone. We suggest that riparian and riverine native fish restoration designs within the Project’s widened reaches include specific measures (where practicable) for development of: a) water shaded by riparian woody vegetation; b) sediment and leaf-fall inputs to aquatic areas; c) channels with steep native-soil stream banks and in-channel woody debris; d) substantial channel diversity including riffle-run-pool-glide sequences, point bars; e) back channel refugia that utilizes upwelling groundwater (low temperature water of higher quality) and provides protected waters during larger flood flow events; f) appropriate channel substrates, including sand, gravel and cobble; g) potential for some channel movement/meander over time in widened channel areas; h) minimal areas of wide ponded or open water; i) riparian hiding cover for native fish (e.g., herbaceous plants and woody shrubs providing overhanging vegetation on stream banks for hiding cover); and j) target fish species passage and appropriate water temperatures and oxygenation levels, including shading of water surfaces through native tree landscaping on the south side of non-widened channel reaches, where practicable and appropriate. Periodic
artificial substrate import (e.g., sand and gravel) into the upper end of the Study Area during the Project life will likely be necessary to maintain some important fluvial processes and conditions for native fish through the Study Area, considering the artificial fluvial conditions of the watershed and upstream channel. The Project should initiate an aquatic exotic species control program for the Study Area: complementary to the level of competitive advantages to native target species provided by the Project (e.g., through channel morphology, riparian cover, etc., as outlined above), periodic direct control of the problematic exotic aquatic species should be implemented in the Study Area, including mosquito fish, tilapia, common carp, green sunfish, fathead minnow, bullfrog, red swamp crayfish \((Procambarus clarkii)\), and other species, as appropriate. The closer the River is restored to natural conditions, the greater the competitive advantage for native species over exotic species, with concomitantly less control of exotic species needed. Considering the conditions of the watershed and the constraints of the Study Area, it is very likely that periodic control of some exotic aquatic species would be needed in perpetuity in order to maintain native fish and their habitats in the Study Area.

**RESPONSE 10:**

As described in the response to Recommendation 7, detailed designs will focus on providing the hydrologic regime, substrates, and vegetation required by arroyo chub and Santa Ana sucker. Detailed designs will also consider the incorporation of opportunities for aquatic and terrestrial passage in hard bottom reaches. Implementation of such measures would depend on the detailed design and hydraulic analysis developed during the detailed design phase, to ensure that they are not in conflict with flow conveyance requirements or other constraints on the project. The Corps will continue to coordinate with USFWS during the development of detailed designs to ensure that the appropriate habitat parameters and design elements are captured.

Sediment import is included as a potential adaptive management action in the Monitoring and Adaptive Management Plan. If monitoring determines that additional sediment is needed to achieve suitable native fish habitat, sediment import could be implemented.

As described in Response 9, Corps guidance on ecosystem restoration directs the Corps to focus on restoring structure, function, and dynamic processes of habitats that have been degraded (EP 1165-2-501; EP 1165-2-502). Focus on presence of particular species of wildlife, and absence of undesirable wildlife species, is expected to be within the jurisdiction of wildlife resource agencies or local entities. Removal of non-native fish could be implemented by resource agencies or other interested entities separate from this project. The Corps and non-Federal sponsor would coordinate with the proponent and the agencies with jurisdiction over such removals to ensure the compatibility of the program proposed with the restoration project, including operation and maintenance activities.
**RECOMMENDATION 11**
Feral mammal populations should be controlled in Project restoration areas, as practicable and appropriate. As part of restoration designs, competitive advantage over exotic mammals should be provided to native species to the extent practicable.

**RESPONSE 11:**
As described in Response 9 and 10, focus on presence of particular species of wildlife, and absence of undesirable wildlife species is expected to be within the jurisdiction of wildlife resource agencies or local entities. General wildlife surveys are included as part of monitoring in the Monitoring and Adaptive Management Plan. If monitoring documents feral or nuisance mammals, the Corps would inform the Adaptive Management Team member agencies, one or more of which may implement a removal program separate from the restoration project or identify other entities interested in doing so. The Corps and non-Federal sponsor would coordinate with the proponent and the agencies with jurisdiction over such removals to ensure the compatibility of the program proposed with the restoration project, including operation and maintenance activities.

**RECOMMENDATION 12**
Project designs and objectives should include greater specificity regarding minimum levels of ecological functions and values to be created or enhanced. As currently written, the designs, objectives, and criteria are difficult to assess as to the basic or minimum ecological functions that would be gained. We suggest the use of appropriate umbrella species to help briefly outline/translate minimum ecological functions to be restored in meaningful ways, and for planning, design, and implementation purposes.

As such, we suggest that the Project include restoration of specified minimum acreages of functional habitats in the long-term for typical restoration planning species for southern California riparian areas, including vireo, chat, and yellow warbler. These species are excellent umbrella planning species that guide restoration for a variety of currently uncommon or extirpated native riparian wildlife species in the Project area by targeting the necessary components of relatively high-function riparian natural communities with a variety of vegetation structures, densities, and seral stages. For example, vireo, yellow warbler, and chat typically utilize different forms, configurations, and seral stages of riparian scrub/woodland/forests.

**RESPONSE 12:**
As described in Response 1, the objectives as currently defined are appropriate and

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25 The 2013 EIS/EIR provides a proposed target objective to restore a “minimum of one habitat node with a minimum width of 250 meters (820 feet) to support high frequencies” of vireo. In our opinion this and the other related objectives remain too vague to effectively evaluate the minimum that would be accomplished for target species from an ecological restoration perspective.
reflective of the naturally occurring habitat that the project restoration is proposing to achieve. Objectives are described in Section 4.2 of the IFR, with measurable objectives criteria outlined in Section 4.2.2. The final array of alternatives meet these objectives criteria based on Corps standards as described in Section 6.2, Tables 6-1 and 6-2. Detailed designs will provide more specificity in terms of habitat, ecological, and hydrologic features to be created and restored based on the necessary habitat components for such recommended target species.

The Corps will continue to coordinate with USFWS during the development of detailed designs to ensure that the appropriate habitat parameters for such umbrella species are captured.

**RECOMMENDATION 13**

Any federally listed species occupying the Project footprint should be the subject of consultation under the Endangered Species Act, as appropriate. An unknown number of vireo likely occupy the Project direct activity footprint and would likely be positively affected by the beneficial aspects of the Project and temporarily adversely affected (through loss of habitat and function) by the action’s construction activity of riparian vegetation clearing within seasonally occupied habitat in the River. As such, the action would likely warrant consultation. Appropriate surveys should be performed to determine occupation and usage areas (protocol surveys of the Study Area for vireo have apparently not been performed in the last decade; recent surveys of all appropriate vireo habitat should have been performed and reported during development of the 2013 EIS/EIR). Any listed species expected to be attracted to the Project area that would subsequently be potentially adversely affected by Project operations or maintenance should also be monitored and addressed through consultation (for instance, potential translocation and establishment of Santa Ana sucker).\(^{26}\)

**RESPONSE 13:**

As described in previous coordination and in footnote 26, Section 5.5.1 of the IFR outlines that Section 7 of the ESA requires consultation with USFWS if the project would affect listed species. As documented in Section 10.1 of the IFR, the Corps determined that the proposed project would have no effect on federally listed threatened or endangered species.

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\(^{26}\) In email attachment to us dated 25 November 2014, the Corp[s] commented: “Section 5.5.1 of the Draft IFR outlines that Section 7 of the ESA requires consultation with USFWS if adverse impacts to listed species are anticipated. Under Section 10.1 of the Draft IFR, the Corps determined that the proposed project would have no effect on federally listed threatened or endangered species. The Corps will continue to review conditions to determine if endangered species may be present, and coordinate or consult with USFWS as necessary through the design and construction of each project phase/feature. Endangered species surveys will be conducted during the detailed design phase and in the nesting season(s) immediately prior to construction within any potentially suitable areas to confirm presence or absence of federally and state listed threatened and endangered species. The Corps will continue to coordinate with the USFWS throughout the design and construction period, and consult under ESA if necessary.”
Marginal habitat for the federally endangered least Bell’s vireo (*Vireo bellii pusillus*) exists within the vegetated portions of the channel within the study area in Reaches 2, 4, 5, and 6. Riparian vegetation in these reaches is linear and confined, and lacks suitable adjacent foraging habitat. Vireo were observed within the study area in 2007; however the most recent protocol surveys in 2009 did not detect vireo. An incidental observation of an unpaired male vireo near Taylor Yard was documented in April 2013 during a one-day nesting bird survey of the area. A similar one-day nesting survey of the area in May 2013 did not detect vireo.

The recommended plan will avoid impacts to least Bell’s vireo. Least Bell’s vireo are not expected to be present in the study area and are not known to nest in the study area due to the marginal existing habitat. In the locations where vireos were observed during 2007 protocol surveys and from incidental observations in 2013 (Glendale Narrows Reach 6), the proposed construction will target removal only of existing non-native vegetation. In areas where marginal habitat for the least Bell’s vireo exists, vegetation would be removed outside of the breeding season. Potential nesting habitat would be avoided. The Corps has determined that there will be no effect to least Bell’s vireo.

Protocol level surveys for least Bell’s vireo would be performed during the detailed design phase and in the nesting season(s) immediately prior to construction of each feature within any potentially suitable areas to confirm presence or absence of this species within the study area. The Corps will continue to coordinate with the U.S. Fish and Wildlife Service and the California Department of Wildlife throughout the design and construction period, and would consult under the Endangered Species Act if conditions change such that the Corps determines the project may affect the vireo or other listed species. With implementation of the alternative, riparian vegetation would be further expanded through widening and restoration of river adjacent areas, which could potentially support future populations of vireo.

No other special status species, including the southwestern willow flycatcher and coastal California gnatcatcher, are expected to occur due to the degraded conditions within the study area and lack of suitable habitat. Impacts to threatened and endangered species are not expected to occur. Construction would be temporary, and overall would benefit endangered species by expanding native riparian, riverine, and wetland habitat.

The Corps will continue to coordinate with the U.S. Fish and Wildlife Service and the California Department of Wildlife throughout the design and construction period.

**RECOMMENDATION 14**

A table describing the various acreages of all of the existing conditions in the Project alternatives’ direct activity footprints should be developed. Only portions of this information
were available in the 2013 EIS/EIR in any form. This table (and related map) should describe land uses, wetlands, and natural communities acreages (pre- and post-Project alternative), and should clearly demonstrate the specific biological impacts and gains that would be provided by the proposed Project alternatives, by acreage and natural community/land use type. In this way the Project can be evaluated for what resources would be lost and gained with implementation. We suggest that this be standard practice for most Corps projects.

**RESPONSE 14:**
Information regarding acreages of habitats created is provided in Table 6-7 of the IFR. Chapter 7 of the IFR describes the Recommended Plan and NER Plan in terms of features restored by reach. The Corps will continue to provide detailed restoration and habitat information during the PED (Pre-Construction Engineering & Design) phase as coordination with USFWS on detailed project features continues.
Colonel Kimberly M. Colloton, PMP District Engineer  
U.S. Army Corps of Engineers, Los Angeles District  
915 Wilshire Boulevard, Suite 930  
Los Angeles, California 90017-3409

Subject: Revised Final Fish and Wildlife Coordination Act Report on the Los Angeles River Ecosystem Restoration Project, Los Angeles County, California

Attention: Josephine Axt, PhD

Dear Colonel Colloton:

Enclosed is our Revised Final Fish and Wildlife Coordination Act Report (Report) for the proposed Los Angeles River Ecosystem Restoration Project (Project) in Los Angeles County, California. This Report is provided in fulfillment of Scope of Work Agreement Number W81EYN72434461 between our agencies, requesting us to provide Draft and Final Fish and Wildlife Coordination Act reports for the Project. This Report is prepared in accordance with the Fish and Wildlife Coordination Act (FWCA; 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and constitutes the revised final report of the Secretary of the Interior on the Project as required by section 2(b) of the Act.

The primary concern and mandate of the U.S. Fish and Wildlife Service (Service) is the protection of public fish and wildlife resources and their habitats. The Service has legal responsibility for the welfare of migratory birds, anadromous fish, and endangered animals and plants occurring in the United States. Specifically, the Service administers the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.), the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703 et seq.), and the FWCA. The purposes of the FWCA are to recognize the contribution of fish and wildlife resources to the Nation and the increasing public interest and significance thereof due to expansion of our national economy and other factors, and to ensure that fish and wildlife conservation receives equal consideration and is coordinated with other features of water-resources development programs (16 U.S.C. 661). Because the Project would involve changes to a water body, pursuant to Section 2(a) of the FWCA, the Corps is consulting with the Service on the action. Per Section 2(b) of the FWCA, our goal herein with our report is to provide “justifiable means and measures” for fish and wildlife conservation purposes that we “find should be adopted to obtain overall project benefits.”
If you have any questions regarding the Report, please contact Jon Avery at 760-431-9440, extension 309.

Sincerely,

G. Mendel Stewart
Field Supervisor
REVISED FINAL
FISH AND WILDLIFE
COORDINATION ACT REPORT

for the proposed

Los Angeles River Ecosystem Restoration Project
Los Angeles County, California

Prepared for the
U.S. Army Corps of Engineers
Los Angeles District
Los Angeles, California

By the
U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, California

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EXECUTIVE SUMMARY

Consistent with the requirements of the FWCA, the Service’s goal with this report is to: suggest appropriate measures for restoring or enhancing fish and wildlife resources in the Project region; determine the possible damage from proposed Project activities on fish and wildlife resources; and make recommendations for preventing, minimizing, and mitigating loss or damage to these resources from the proposed Project. This report was authored by Jon Avery of the Carlsbad Fish and Wildlife Office. In January 2014 we provided a Preliminary Draft Coordination Act Report on the proposed Project to the Corps. In September 2014 we delivered a Final Draft Coordination Act Report to the Corps. Based on a series of meetings between the Service and the Corps, and a revised proposed Project description and background information subsequently provided by the Corps in November 2014, we developed this Revised Final Coordination Act Report.

The Corps published a Feasibility Study and Environmental Impact Statement/Environmental Impact Report (2013 Draft EIS/EIR) for the proposed Project in September 2013. The Corps Los Angeles District is the Federal lead agency for the proposed Project under the National Environmental Policy Act (NEPA) of 1969. The local lead agency and non-Federal sponsor responsible for implementing the California Environmental Quality Act (CEQA) is the City of Los Angeles (City). The Corps and City prepared the 2013 Draft EIS/EIR, jointly with a Feasibility Study (together also known as an Integrated Feasibility Report), which evaluates various alternatives for the Project purpose of partially restoring approximately 11 linear miles (mi) of the Los Angeles River (River), while providing recreation and maintaining existing levels of flood risk management. This 11-mi stretch of the River, also known as the Glendale Narrows, stretches from approximately Griffith Park (in the City of Burbank) downstream to downtown Los Angeles, in Los Angeles County, California (see Figure 1). This historically perennial reach of the River ranges from about 23 to 33 mi upstream of the Pacific Ocean.

The River lies within the coastal plain of the Los Angeles Basin and has been very highly modified for flood damage reduction purposes. Restoration measures considered for the proposed Project include enhancement and reestablishment of riparian strand, freshwater marsh, and aquatic natural communities, and partial reconnections of the River to major tributaries, portions of its historical floodplain, and the ecological areas of the Santa Monica and San Gabriel mountains and Verdugo Hills. Stated restoration goals for the Project include increased or re-established populations of native wildlife and fish, and enhanced ecological connectivity (e.g., wildlife corridors and linkages) within the Study Area and regionally. Proposed restoration measures would also include the reestablishment of some ecological and physical processes. The 2013 Draft EIS/EIS also evaluates and proposes passive recreation and associated facilities in the River. It evaluates the No Action Alternative and four action alternatives, termed Alternatives 10, 13, 16, and 20. The 2013 Draft EIS/EIR describes the proposed Project’s need, goals, objectives, and the potential environmental effects in detail. As of September 2013 the Corps’ tentatively selected plan was Alternative 13. In May 2014 the Corps gave approval to

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1 At the time we provided a relatively brief preliminary draft report, rather than a typical draft report, per a request from the Corps for the Service to provide a Draft CAR within a short period of time.
Alternative 20 as the Corps preferred alternative. Alternative 20 is the Locally Preferred Plan and the Corps’ recommended plan (USACOE 2014c).

The Planning Objectives for the proposed Project, as identified in the 2013 Draft EIS/EIR, are to:

1. **Restore valley foothill riparian strand and freshwater marsh natural communities:**
   Restore valley foothill riparian natural community types, aquatic freshwater marsh communities, and native fish habitats within the “Area with Restoration Benefits and Opportunities for Revitalization” (ARBOR) reach throughout the Project period of analysis, including restoration of supporting ecological processes and biological diversity, and a more natural hydrologic and hydraulic regime that reconnects the River to some historic floodplains and tributaries, reduces velocities, increases infiltration, and improves natural sedimentary processes.

2. **Increase habitat connectivity:** Increase connectivity of habitats between the River and the historical floodplain, and increase nodal connectivity for wildlife between restored natural community patches and nearby significant ecological zones such as the Santa Monica Mountains, Verdugo Hills, Elysian Hills, and San Gabriel Mountains within the ARBOR reach throughout the period of analysis.

3. **Increase passive recreation:** Include recreation that is compatible with the restored environment in the ARBOR reach throughout the period of analysis.

The proposed Project would, over the long-term, provide partial re-establishment and enhancement of the currently highly degraded or eliminated aquatic/riverine and riparian natural communities within the Glendale Narrows portion of the River.

The riparian and riverine natural communities of the Study Area and environs are currently highly fragmented and generally isolated, and they would largely continue to be so following Project implementation, though with some improvements in connectivity due to Project partial restoration and enhancement as proposed. The ecological functions of such fragments normally depend not only their contiguous size and internal characteristics, but also on their configuration relative to one another and the characteristics of the surrounding landscape (Andren 1992 & 1994; Sisk et al. 1997; Saab 1999; Tewsksbury et al. 2002). As such, additional projects would need to be implemented outside of the Project area in order to restore many of the important riparian and riverine ecosystem functions within the Project footprint. Nevertheless, substantial restoration potential exists within the Study Area, and we view the Project as an incremental step to partial restoration of the River in an urban context.

The Project could have direct, indirect, and cumulative impacts on biological resources during and following the activities of: demolition, clearing, grading, construction, maintenance, and operations throughout the Project life. These potential effects include: a) physical disturbance

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2 On May 28, 2014, Assistant Army Secretary for Civil Works Jo-Ellen Darcy decided to recommend approval of Alternative 20 as the Corps preferred alternative for the proposed Project.
of currently degraded natural communities from these activities; b) impacts on terrestrial, aquatic, and riparian-associated native biota from equipment use; and c) effects from increased/modified noise and human activities (e.g., construction, maintenance, and recreation), nighttime lighting, contaminant release/exposure (from construction vehicles and equipment, maintenance activities, disturbance of existing soils, etc.), and increased siltation and contaminants release into the River waters on site and downstream. Most of these impacts would likely be short-term or temporary; some could be recurrent, such as recreation activities. The proposed Project would likely result in net and long-term gains in ecological functions and values for almost all native species that currently use the areas in the Project reach of the River, depending on Project designs ultimately implemented.

Proposed increases/re-establishment of riparian and riverine natural communities (in both acreage and function) as a result of the Project would likely provide expanded or restored habitats for several resident/migratory/transient native birds, as well as a limited number of native of reptile, amphibian, and smaller mammal species. With some modifications to the proposed designs the Project has potential to re-establish some native fish species that are currently extirpated from the Project area. Additional increases in ecological functions from restoration and enhancement could be gained with some modifications to proposed Project designs, as outlined in our Recommendations below.

The least Bell’s vireo (*Vireo bellii pusillus*; “vireo”), a federally listed endangered species, occurs in the Project footprint and environs in small (undetermined) numbers. The vireo could be adversely affected by Project-related equipment use, nighttime lighting, and/or other human activities associated with construction or operations, including clearing (e.g., temporary or permanent loss of riparian vegetation in some specific locations) of extant vireo habitat, likely during the non-breeding season. Project operations (including recreation) or maintenance activities could potentially disturb breeding vireos attracted to Project restoration areas following Project implementation. Net increases through restoration and enhancement of riparian woodland and scrub areas proposed within the Project footprint as part of the Project would likely provide overall benefits to the vireo, including an undetermined increase in the currently limited (potential) breeding use and carrying capacity of the area, particularly if brown-headed cowbird (*Molothrus ater*) parasitism is controlled in the Project area.

The existing heavily degraded and fragmented ecological conditions within all of the Project Study Area indicate that potential for other Federal or state listed species of any taxa occurring in the Project area during construction is low. As such, other listed species besides the vireo are not likely to be adversely affected by proposed construction activities. Depending on the ecological restoration and enhancement designs ultimately implemented and maintained as part of the Project (see Recommendations below), the Santa Ana sucker (*Catostomus santaanae*), a federally listed threatened species, has some potential to utilize restored riverine reaches in the Project area during the Project life as a result of improved habitat conditions, including water flow and quality parameters, channel form, and riverine substrates. Occasional adverse effects to this species from Project maintenance or operations could occur following any re-establishment of the species in the Project area. Re-establishment of Santa Ana sucker would likely require translocation of the species from extant populations elsewhere in the region following
appropriate restoration measures. Without additional restoration projects implemented beyond the scope of the proposed Project, occupation of the Project area by other federally listed species of any taxa does not currently appear of substantial potential to occur.

In general, while the Project as designed would improve ecological conditions of the Study Area to a less degraded condition, we expect that the proposed Project can be practicably modified to better utilize the restoration potential of the River and provide substantially greater ecological gains from the Project. Compared to current proposed designs, within Project floodplain/channel areas where the existing channel would be widened we generally recommend that Project design plans include:

a) fewer new hard structures be utilized at the ground/channel surface, including those that would modify/control stream flows;

b) increased creation of riverine (aquatic stream) areas with tree-shaded flowing water and native fish refugia within a relatively natural stream geomorphology and associated substrates (e.g., sand and gravel), with concomitant reductions in proposed areas of artificial open or ponded water; and

c) expanded areas of unmaintained native riparian scrub, woodland, and forest natural communities that are situated within the widened/restored floodplain so as to be subject to a relatively natural flooding regime (including periodic denudation flood flows consistent with natural seral stage compositions over the Project life).

We understand that ecologically healthy and accessible urban streams can help expand local businesses and enhance economic, educational, recreational, and social opportunities in nearby communities. Restoring and enhancing urban streams helps re-connect metropolitan residents—youth in particular—to natural open spaces and a relationship with nature. We suggest that the above noted modifications to the Project can be made consistent with all of the stated goals and objectives of the Project, including maintenance of flood risk management capacity, as well as considerable increases and improvements in appropriate recreation, “greening,”3 and human access to the River.

PREFACE

This is the U.S. Fish and Wildlife Service’s (Service) Revised Final Coordination Act Report for the U.S. Army Corps of Engineers’ (Corps) proposed Los Angeles River Ecosystem Restoration Project (Project). Pursuant to the mandates of the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (87 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the Corps is consulting with the Service to ensure that equal consideration is provided for fish and wildlife resources

3 Greening: the process of transforming spaces into more environmentally friendly and/or more naturalistic versions, such as urban green spaces, sustainable landscape improvement projects, and greenways. Planning for a greener townscape involves provision or preservation of greenery with greater sensitivity to the balance between hard-surfaced built-up areas and green vegetated areas.
during the planning of the Corps’ proposed Project. The goal of the FWCA is to ensure that fish and wildlife conservation is an integral part of the development of our Nation's water resources.

The FWCA directs Federal agencies that plan and/or implement water-use projects to incorporate elements into their projects to improve fish and wildlife resources, and to avoid and minimize damages to these resources where feasible (Hearing on Coordination Act Amendments 1958; McBroom 1958). The purpose of the FWCA is to recognize the contribution of wildlife resources to the Nation, the increasing public interest and significance of these resources due to expansion of our national economy and other factors, and to provide that wildlife conservation receives equal consideration and be coordinated with other features of water-resources development programs (16 U.S.C. 661).

This document constitutes the Revised Final FWCA Report in fulfillment of a Military Interdepartmental Purchase Request between the Service and the Corps regarding the potential effects of the proposed Los Angeles River Ecosystem Restoration Project in Los Angeles County, California, on fish and wildlife resources. We have prepared this FWCA Report on behalf of the Secretary of the Interior pursuant to the requirements section 2(b) of the FWCA and in keeping with the intent of the NEPA (P.L. 91-190).

Our analysis of the proposed Project and the recommendations provided herein are based on information in: 1) the Corps’ 2013 Draft EIS/EIR; 2) other reports and data provided by the Corps; 3) the Los Angeles River Revitalization Master Plan (City of Los Angeles 2007); 4) a review of the published and unpublished literature on the history, biota, and ecosystems of the region; 5) field visits by Service personnel; 6) discussions and meetings with professional biologists and representatives from other Federal, state and local agencies; 7) revised proposed Project description, commitments, and information provided to the Service by the Corps by email in November 2014; and 8) our best collective professional judgment.

Our goals in the analysis in this report are to: a) identify and evaluate the potential effects of the proposed Project on fish and wildlife resources and the ecosystems they depend upon within the action area; b) provide suggestions for improving the currently proposed Project designs for ecological restoration and fish and wildlife recreational/nature access; c) recommend methods for avoiding, minimizing, and offsetting potential negative ecological effects of the Project; and d) suggest other actions that the lead agencies can plan and/or implement that would partially restore the natural ecosystems, and/or improve or enhance native fish and wildlife resources, associated with the River.
# TABLE OF CONTENTS

EXECUTIVE SUMMARY ............................................................................................................ ii
PREFACE ..................................................................................................................................... v
LIST OF FIGURES ......................................................................................................................... ix
INTRODUCTION .......................................................................................................................... 1
FISH AND WILDLIFE COORDINATION ACT ......................................................................... 5
DESCRIPTION OF PROJECT REGION AND STUDY AREA ...................................................... 9
PROPOSED PROJECT PURPOSE ............................................................................................... 24
DESCRIPTION OF PROPOSED PROJECT ALTERNATIVES .................................................... 24
RELATIONSHIP OF THE PROPOSED PROJECT TO EXISTING MASTER PLAN ............... 34
DESCRIPTION OF BIOLOGICAL RESOURCES ...................................................................... 35
EFFECTS OF THE PROPOSED PROJECT ON BIOLOGICAL RESOURCES .......................... 61
CUMULATIVE EFFECTS ............................................................................................................... 64
RECOMMENDATIONS ................................................................................................................. 65
LITERATURE CITED .................................................................................................................. 76
LIST OF FIGURES

Figure 1. Project Study Area..............................................................3
Figure 2. Watersheds and tributaries of the Los Angeles River.........................11
Figure 3. Aerial photo of a portion of Reach 1 of the Study Area.........................16
Figure 4. Aerial photo of a portion of Reach 2 of the Study Area .........................17
Figure 5. Aerial photo of a portion of Reach 3 of the Study Area .........................18
Figure 6. Aerial photo of a portion of Reach 4 of the Study Area .........................19
Figure 7. Aerial photo of a portion of Reach 5 of the Study Area .........................20
Figure 8. Aerial photo of a portion of Reach 6 of the Study Area .........................21
Figure 9. Aerial photo of a portion of Reach 7 of the Study Area .........................22
Figure 10. Aerial photo of a portion of Reach 8 of the Study Area .......................23
Figure 11. Natural community types along the Los Angeles River, 1896 and 2010........36
INTRODUCTION

The Los Angeles region’s history is inseparably intertwined with the River. The historic occupation, settlement, and development patterns of the region were centered on the River due to its huge importance for residential, municipal, and agricultural water supply. Several large Native American Tongva villages and the first Spanish settlement in the region (in the area of what is now downtown Los Angeles) were developed adjacent to the River near the Study Area, mostly due to the perennial supply of surface water the River provided along its middle reaches (Crespi 2001; Gumprecht 1999). An extensive series of contiguous riparian natural communities, including woodlands and forests, sided the River in the Project area during this period (Crespi 2001; Gumprecht 1999). In the Project area the River’s floodplain provided relatively flat and fertile agricultural land that was heavily used during and following the 18th/19th century Spanish settlement period. Competing uses of the River corridor and floodplain in modern society (including flood damage reduction facilities), combined with large-scale alteration the River’s watershed over the last hundred years, have drastically reduced the abundance and function of the aquatic and riparian natural communities of the River (Garrett 1993).

Streams and rivers, with their associated floodplain and riparian ecosystems, provide essential or highly important habitat elements for much of the region’s native non-marine fish and wildlife species. Much of southern California’s native terrestrial vertebrate wildlife species depend on riparian ecosystems for essential portions of their life histories (Schoenherr 1992).

Over the past century, increasing urbanization of watersheds in southern California has resulted in large losses and degradation of wetlands and riparian areas (Dahl 1990, Holland et al. 1995). As a result of the wholesale changes to the River and its watershed over the last 100-plus years, the current abundance and diversity of native flora and fauna along the River has drastically diminished as compared to its pre-channelization state, as evidenced by a comparison of current biota with that documented by literature, collections, and historical photographs (Garrett 1993). Commensurate with these reductions in River ecosystems has been the urban development of the surrounding areas, and the concomitant greatly diminished opportunities for exposure and experiences in nature for local residents. The River, as with most low-lying points in the landscape, is strongly influenced by the stormwaters, pollutants, and streamflow warming that characterize this urban development and the associated water catchment.

Historically, typical open channel flood damage reduction (“flood control”) systems in the U.S. have been designed for mostly a single function: to enhance human safety by reducing flood damage to human landscape infrastructure. This single-purpose objective is increasingly an untenable practice (Williams and Swanson 1989; Greco and Larsen 2014). Because river and stream systems in human-dominated landscapes often play important conservation roles for biota (e.g., habitats for sensitive species) and exposing/connecting people with nature, it is important that flood risk management planning be integrated with conservation planning principles and goals where practicable. In river and stream systems, we suggest that flood damage reduction channels should be multifunctional where feasible, and be designed to accommodate native vegetation as well as geomorphic processes. In many cases, expanding the flood channel
footprint and unlined channel bottom while increasing design channel roughness coefficients (Manning’s $n^4$) with vegetation can be performed while still effectively meeting multifunctional objectives (Greco and Larsen 2014).

The stated primary purpose of the proposed Project alternative plans (including Corps preferred alternative) considered in the 2013 Draft EIS/EIR is to restore approximately 11 mi of the River from Griffith Park to downtown Los Angeles by reestablishing or increasing riparian strand, freshwater marsh, and aquatic natural communities and reconnecting the River to major tributaries, its historic floodplain, and the regional ecological zones of the Verdugo Hills and Santa Monica and San Gabriel mountains at the central nexus of the River watershed’s former and existing ecosystems, while maintaining existing levels of flood risk management. A secondary purpose is to provide recreational opportunities consistent with the restored ecosystem within the 11-mi Project reach of the River.

Implementation of any substantial project in the Corps’ Study Area\(^5\) may indirectly affect biological resources beyond the political or jurisdictional boundaries used to delimit the Study Area chosen by the Corps. For example, most water and a substantial portion of the sediments and contaminants that enter or occur in the Study Area move downstream along the River and ultimately move beyond the Study Area limits. Also, many invasive exotic and native plant, fish, and wildlife species typically move through and beyond the Study Area limits, both upstream and downstream. Therefore, the analysis in this Final FWCA Report considers all potential appreciable ecological effects associated with the alternatives to be evaluated, not just those effects limited to the Study Area. We also considered in our analysis the potential effects to biological resources resulting from the possible interactions between the proposed Project and other known regional planning efforts.

Ecological restoration is an intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity, and sustainability (Society for Ecological Restoration 2004). Frequently, the ecosystem that requires restoration has been degraded, damaged, transformed, or entirely destroyed as the direct or indirect result of human activities. Restoration attempts to return an ecosystem to its historic ecological trajectory. Historic conditions are therefore the ideal starting point for restoration design. The restored ecosystem will not necessarily recover its full former state, since contemporary constraints and conditions may cause it to develop along an altered or limited trajectory. The historic conditions and trajectory of a severely degraded ecosystem may be difficult or impossible to determine with accuracy. Nevertheless, the general direction and boundaries of that trajectory can be established through a combination of knowledge of the damaged ecosystem’s pre-existing structure,

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\(^4\) The empirical Manning roughness coefficient characterizes channel surface roughness and thus characterizes the resistance or impedance to flow. Small values of $n$ such as $<0.012$ describe a smooth surface with little resistance (such as concrete), whereas large values of $n$ such as $>0.15$ describe a rough surface consisting of trees and boulders posing greater resistance (Mount 1995). The Manning equation is a key tool used by civil engineers to design open channel flood control structures.

\(^5\) Study Area – the Study Area refers to the area that was studied in the 2013 Draft EIS/EIR.
Figure 1. Project Study Area
composition and functioning, studies on comparable intact ecosystems, information about regional environmental conditions, and analysis of other ecological, cultural and historical reference information. These combined sources allow the historic trajectory or reference conditions to be charted from baseline ecological data and predictive models, and its emulation in the restoration process should aid in piloting the ecosystem towards improved ecological health and integrity.

An ecosystem is considered recovered/restored when it contains sufficient biotic and abiotic resources to continue its normal development without further assistance or subsidy. It will sustain itself structurally and functionally and will demonstrate resilience to normal ranges of environmental stress and disturbance. The eight attributes listed below provide a basis for determining when partial or full restoration would be been accomplished (Society for Ecological Restoration 2004). The full expression of all of these attributes is not essential -- it is only necessary for these attributes to demonstrate an appropriate trajectory of ecosystem development towards the intended goals or reference.

1. The restored ecosystem contains a characteristic assemblage of the native species that occur in the reference ecosystem and that provide appropriate community structure.
2. All functional groups necessary for the continued development and/or stability of the restored ecosystem are represented or, if they are not, the missing groups have the potential to colonize by natural means.
3. The physical environment of the restored ecosystem is capable of sustaining reproducing populations of the species necessary for its continued stability or development along the desired trajectory.
4. The restored ecosystem apparently functions normally for its ecological stage of development, and signs of dysfunction are absent.
5. The restored ecosystem is suitably integrated into a larger ecological matrix or landscape, with which it interacts through abiotic and biotic flows and exchanges.
6. Potential threats to the health and integrity of the restored ecosystem from the surrounding landscape have been eliminated or reduced as much as possible.
7. The restored ecosystem is sufficiently resilient to endure the normal periodic stress events in the local environment that serve to maintain the integrity of the ecosystem.
8. The restored ecosystem is self-sustaining to the same degree as its reference ecosystem, and has the potential to persist indefinitely under existing environmental conditions.

Ecosystem restoration is a primary mission of the Corps Civil Works program (USACE 2014a). Pursuant to Corps policy, ecosystem restoration projects should examine the need for improving or re-establishing both the structural components and the functions of the natural system (USACE 2014b). Restored ecosystems should mimic, as closely as possible, conditions which would occur in the area in the absence of human changes to the landscape and hydrology. In some instances, a return to pre-disturbance conditions may not be feasible (USACE 2014a), such as within the Study Area. In situations where partial restoration may be possible, the goal of Corps Civil Works projects is typically significant and valuable improvements of degraded ecological resources (USACE 2014a). Indicators of successful restoration would include the presence of a large variety and number of native plants and animals, the ability of the area to sustain larger numbers of certain indicator species or more biologically desirable species, and the
ability of the restored area to continue to function and produce the desired outputs with a minimum of continuing human intervention (USACE 2014b). Those restoration opportunities that are associated with wetlands, riparian and other floodplain and aquatic systems are most appropriate for USACE involvement (USACE 2014b).

After examining the needs and potential for improving or re-establishing both the structural components and ecological functions of the Study Area, we expect that partial reestablishment of the attributes and functions of the former natural self-regulating ecosystems of the River is practicable. Our design analysis and Recommendations herein take, in part, a realistic hydrological and geomorphic approach to the substantial constraints and opportunities presented by the River and environs in their current state. We have evaluated past development impacts, historical uses, fluvial sediment transport, current and potential channel forms, riparian and riverine functions, hydraulics (e.g., channel water flow), flood damage reduction and right-of-way constraints, and potential recreation in the watershed and Study Area. The past and ongoing anthropogenic impacts along the River have drastically altered the geomorphic processes and disconnected the River from its former floodplain. Sediment erosion/transport/deposition potential within most of the length of the River is currently artificially very low (and would remain so with the Project) due to channelization and hard surface bottom and slope protection along most of the River, and development within the watershed. Floodplain interaction with the River and overbank flows are vital to maintaining balanced riparian and riverine ecosystems of moderate to high function and integrity; as such, even partial restoration of these processes (e.g., within future proposed widened River floodplain reaches) is essential to partial restoration of basic River ecosystem functions and biological integrity. Our Recommendations also take a whole system approach to River restoration that, if implemented, would result in appreciably increased riparian and riverine systems regeneration and improved ecological sustainability and function. Nevertheless, even partially restoring substantial ecological connections (such as wildlife corridors from areas within the Study Area to larger natural areas outside) in and with the Study Area will remain highly challenging, considering the existing fragmented conditions, hard structures, and extensive development within and surrounding the Study Area, as well as the Project scope, competing proposed uses, and likely available resources.

FISH AND WILDLIFE COORDINATION ACT

The FWCA directs or authorizes consultation, reporting, consideration, and in many cases, installation/implementation of fish and wildlife conservation features. The authorities of the FWCA are considered to be “supplementary legislation” to the various Federal project authorizations, such as the Corps public works authorizations (Smalley and Mueller 2004). The FWCA conditions or supplements other water development statutes to require consideration of recommendations generated under the FWCA procedures, including portions of the Clean Water Act (Zabel v. Tabb, 430 F2d 199 [5th Cir. 1970] cert. denied 401 U.S. 910 [1972]). For Federal water resources development projects, the FWCA requires that fish and wildlife conservation receive equal consideration by Federal agencies with other project purposes, and that such conservation be coordinated with other project features. The FWCA authorizes the project implementation of means and measures for both mitigating losses of fish and wildlife resources, and for enhancing these resources beyond offsetting project effects (Smalley and Mueller 2004).
Sections 1 and 2 of the FWCA direct and authorize Federal agencies that they have an affirmative duty to both conserve and improve wildlife resources in connection with water development projects (Metcalf 1958; Smalley and Mueller 2004). While acceptance of Service’s conservation recommendations is not mandatory, the FWCA does provide clear, general authority for the Corps to fund and construct measures that will provide for fish and wildlife conservation and enhancement as part of their water projects, and directs that fish and wildlife conservation is a goal of all Federal water projects (Smalley and Mueller 2004). Similarly, while the results of the FWCA consultation with the Service are not binding, the Federal agency must strongly consider input received during consultation to prevent loss or damage to wildlife resources and to provide for measures to mitigate such impacts.

To help accomplish the above outlined requirements, Section 2(a) of the FWCA establishes that preconstruction planning on water project development shall be coordinated with the Service through consultation. The findings and recommendations of the Service under the FWCA are communicated to project decision makers by three main means: orally in the interactive planning process, through notes and memoranda/letters, and through the formal reporting authorized by section 2(b). Section 2(b) requires that the Service provide a report and recommendations that determine “the possible damage to wildlife resources” and provide “means and measures that should be adopted to prevent the loss of or damage to such wildlife resources, as well as to provide concurrently for the development and improvement of such resources.” The “means and measures” refer to both those for mitigation of impacts, and for enhancement fish and wildlife resources (Smalley and Mueller 2004). The purpose of the Section 2(b) report is to document and recommend: it should document the results and findings of the Service’s study, planning, and coordination. It should recommend those actions considered necessary by the Service to accomplish the fish and wildlife conservation goals of the FWCA.

Section 2(b) also requires Federal agencies to give “full consideration to the report and recommendations” of the Service and directs Federal agencies that “the project plan shall include such justifiable means and measures for wildlife purposes as the reporting agency finds should be adopted to obtain maximum overall project benefits.” The 2(b) report must be made available to the Congress or other authorizing agents when decisions are made to authorize (or not to authorize, or authorize with modifications) a project. Section 2(c) of the FWCA authorizes the Service to: conduct surveys and investigations to determine the possible damage of proposed developments on wildlife resources; to make recommendations for preventing their loss or damage; and to offer measures for developing and improving these wildlife resources.

The definitions of the terms “mitigation,” “compensation,” and “loss prevention,” (associated with “conservation of wildlife resources by preventing loss of and damage to such resources”) contained in Section 2 of the FWCA are sometimes subject to confusion. The objective of mitigation under the FWCA is to “prevent loss of or damage to” fish and wildlife. Mitigation under the FWCA is accomplished through the use of a five step process for reducing or eliminating losses from a project: avoidance, minimization, rectification, rectification over time, and compensation. Compensation is used to mitigate for unavoidable losses after the first four
components of mitigation have been applied. The terms "wildlife" and "wildlife resources," as used in the FWCA, "include birds, fishes, mammals and all other classes of wild animals and all types of aquatic and land vegetation upon which wildlife is dependent" [Section 6(b)]. Thus, although the FWCA uses the term wildlife, it is representing all fish and wildlife and their habitats/ecosystems. Evaluations made under the FWCA can, therefore, take into consideration a wide spectrum of environmental factors, including a watershed or ecosystem approach (Smalley and Mueller 2004). Per Section 2(d) of the FWCA, fish and wildlife conservation costs (mitigation and enhancement) are to be considered Federal project costs. No regulations for implementing the provisions of the FWCA currently exist.

APPROACHES TO FLOOD RISK REDUCTION, RIVERINE AND RIPARIAN MANAGEMENT, AND ECOLOGICAL DESIGN OF OPEN CHANNELS

In most developed countries, rivers proximate to urban development typically have open channel flood damage reduction systems designed with fixed parameters and narrow objectives that frequently overlook important ecological functions of river systems, making these channels of limited value to ecological conservation. The conventional single objective for open channel design is to convey water as efficiently as possible, and historically such designs have been implemented to help protect urban and rural infrastructure. Using this utilitarian goal, flood water is efficiently routed with the goal of reducing property damage and loss of human lives, and the open channel design is mainly driven by minimizing channel right-of-way space and construction costs. The most extreme form of this open channel design replaces the entire river channel and its floodplain by smooth trapezoidal- or rectangular-shaped concrete conveyance structures with slopes high enough to contain design flows.

We herein suggest that open channel flood risk management designs consistently should have co-equal goals of flood damage reduction and ecological conservation. This multifunctional approach necessitates adopting a 'regenerative design' paradigm (Cole 2012; Zari 2012) combined with 'reconciliation ecology' (Rosenzweig 2003) to create and sustain viable and productive river systems. Our approach builds on previous work such as the “space for the river” concept proposed in the Netherlands and elsewhere (Nienhuis & Leuven 1998). In recent decades it has been increasingly recognized that riverine and riparian ecosystems have highly important ecological conservation values and provide human communities with numerous ecosystem services (Opperman et al. 2009; Thorp et al. 2010). Various aspects of the fundamental mechanics of these ecosystems have been described relatively recently in the literature and they illustrate why conventional open channel flood channel design has been detrimental to ecological conservation. Key essential natural community and ecosystem patterns, processes, and concepts, which are not considered in conventional flood damage reduction channel design, include: naturalized flow regimes (Poff et al., 1997), flood-pulse (Junk, Bayley & Sparks, 1989), geomorphically effective stream power (Larsen, Fremier, & Greco, 2006), channel meander (Hickin, 1974), floodplain age (Greco, Fremier, Larsen, & Plant 2007; Hooke, Harvey, Miller, & Redmond 1990), bedload transport (Kondolf 1997), vegetation dynamics(Amoros and Wade 1996), patch dynamics and minimum dynamic area (Greco 2013; Pickett & Thompson 1978; Wu & Loucks 1995), minimum dynamic area for channel meander using set-back levees (Larsen, Girvetz, & Fremier 2006); river continuum (Vannote, Minshall,
Cummins, Sedell, & Cushing 1980), large woody debris recruitment (Latterell & Naiman 2007), large river ecology (Johnson, Richardson, & Naimo 1995), and riparian landscape ecology (Malanson 1993). It is important that in the planning of river and stream projects that these riverine-riparian landscape patterns, processes, and concepts are considered and integrated into multifunctional open channel design processes where possible, such that essential ecological functions and values are maintained or enhanced for ecological conservation.

Because conventional flood damage reduction channel design seeks to minimize right-of-way width and economic costs, the typical open channel footprint (land area utilized) is minimized, the channel depth is increased with the use of floodwalls or levees, and the roughness coefficient is minimized. Herein lie the two main reasons why conventional flood channel design is of little conservation value. First, channel water flow capacity is created or increased by artificial means to constrict the floodplain instead of using floodplain width to expand capacity and decrease depth. Second, the design use of very smooth roughness coefficient values requires the routine, systematic removal of any trees, shrubs or woody debris that subsequently grow or get deposited within the channel that act to increase the roughness of the channel beyond its design roughness value. However, it is precisely this roughness component that has critically important value as habitats for most native aquatic and terrestrial organisms. Engineers will frequently design channels to create additional capacity (e.g., flood conveyance) by creating higher levees along a narrow channel to contain floodwaters to a smaller footprint thus reducing the width of the floodplain and lowering land acquisition costs. At the design (peak) flow the water is typically deep and the velocity is high. Consequently any non-flying terrestrial animals living in the flood channel typically must be able to reach refugia or drown. Refugia from floodwaters can be provided by high ground, a nearby tree, or a debris pile that rises above the flood water surface. In large river systems flood damage reduction channels can be wide with few or no trees in the floodplain, and for many terrestrial organisms, traversing long distances to safety is dubious. In a study on the Sacramento River researchers found an 86 percent decline in the presence of small mammals in areas subject to flooding as compared to non-flooded areas (Golet, Hunt, & Koenig 2013). The use of setback levees (i.e., widening the distance between levees to increase channel width) to reduce channel depth and create additional capacity and conveyance is a more ecologically beneficial design practice (Mount 1995) and also provides opportunities for refugia habitats from floodwaters.

The second problem with a conventional engineering approach is designing the channel with very smooth Manning roughness coefficients and requiring that the n value be maintained overtime to pass the peak flow. Around the world millions of dollars are spent to remove vegetation that grows near the channel or in the floodplain to maintain these smooth roughness coefficients. In those same landscapes where flood damage reduction channels are cleared of their riparian vegetation are often sensitive terrestrial and aquatic species whose floodplain habitats are increasingly rare.
DESCRIPTION OF PROJECT REGION AND STUDY AREA

Region

Coastal southern California is a semi-arid region with a Mediterranean climate dominated by long dry summers and usually brief winters with short, sometimes intense cyclonic winter storms. The taller mountains in the region receive a portion of their precipitation as snow, which typically contributes water to streams until mid- to late-summer. Much of the higher elevations of the region are undeveloped and remain partially protected in national forests and a network of national, state, and county parks. The lower elevations in the region have been pervasively altered by urbanization or conversion to agriculture (Mazor et al. 2011). Wildfires and drought are frequent in the region. By area, the overall coastal southern California region is 59 percent undeveloped open space, 28 percent urban, and 13 percent agricultural (NOAA 2001).

Watersheds within the Project surrounding region fall into two basic types: those characterized by short coastal streams draining mountain ranges immediately adjacent to the coast and those watersheds containing larger river systems, such as the River, that extend inland through gaps in the coastal ranges.

The River is located within the California Floristic Province, an 8-million-acre (ac) region that extends from southern Oregon to northern Baja, Mexico, and encompasses areas west of the interior deserts. The California Floristic Province is considered one of the world’s 25 most biologically rich and threatened terrestrial ecoregions (Myers et al. 1999). Indeed, while these 25 ecological hotspots cover less than 1.5 percent of the earth’s land surface, they account for roughly 60 percent or more of the remaining diversity of life on earth (Mittermeier et al. 1998, 1999). The California Floristic Province is a biological hotspot for nearly every taxonomic group (except freshwater fish) including plants, invertebrates, birds, mammals, and reptiles, partly due to the region’s mild Mediterranean climate. The California Floristic Province harbors more endemic plant and animal taxa and more identifiable subspecies than any other area of comparable size in North America (Calsbeek et al. 2003); 44 percent of its plant and vertebrate species are endemic (restricted) to California (Myers et al. 1999). The California floristic province harbors more plant species than the central and northeastern United States and Canada combined, and over 30 percent of the known North American insect species north of Mexico (Raven & Axelrod 1978; Arnett 1985; Raven 1988; Messick 1997). California supports the second-greatest number of species listed under the Endangered Species Act in the United States, following to the State of Hawaii (USFWS 2001). This concentration of endangered and threatened species stems predominately from a combination of very high biological diversity and ongoing losses and threats from growing human population and associated development.

The River watershed/drainage dominates the geographical setting of the nation’s second largest urban area (Garrett 1993). Los Angeles County has the largest human population of any county in the nation, and is exceeded by only eight states. Approximately 27 percent of California's residents live in the County. More than 1 million of the 10.4 million Los Angeles County residents live in unincorporated areas with the other 9.3 million living in 88 cities, located throughout a 4,084-square-mile (mi²) area (County of Los Angeles 2013). Rainfall in the Project region typically falls between November and April, with monthly precipitation rarely exceeding
4 inches (in) (Kwan et al. 2010). Annual average rainfall since 1877 in the Study Area is approximately 15 in (Los Angeles Almanac 2013). Daily high temperatures range from 68 deg. Fahrenheit (F) to 86 deg. F, and lows range between 48 deg. F and 68 deg. F (California Department of Water Resources 2013).

The River within the City of Los Angeles was, and is, much more than the approximately 750 ac/32 mi (City of Los Angeles 2007) of existing flood channel facility. The River remains closely associated and dependent upon the watershed surrounding it (see Figure 2 below) (Garrett1993). Before channelization, the River was naturally an alluvial river that migrated and flooded periodically across a wide flood plain that is now occupied by developed portions of Los Angeles, Long Beach, and other communities (Gumprecht 1999). Much of the precipitation within the River’s watershed, predominately rainwater, historically and currently collects within a large groundwater basin underlying the San Fernando Valley. This groundwater basin historically and currently drains as surface water flow in the River through the Project Study Area (Gumprecht 1999).

The River drains an 834 mi² watershed, with an overall length of the River and tributaries combined of 322 mi. Within the watershed, current land use (all tributaries combined) is approximately 40 percent open, 1 percent agricultural, and 59 percent urban (Mazor et al. 2011).

The River was historically a 51-plus-mi-long interconnected system of riparian and riverine natural communities (Gumpect 1999, Garrett 1993). It was and remains one of the largest sources of fresh water along the southern California coast (Friends of the Los Angeles River 2008). The River provided a source of water and food for the Gabrielino Indians prior to European occupation of the region. The Gabrielinos were gatherers and hunters who lived primarily off the acorns from the abundant oak trees that formerly occurred along the River’s floodplain, as well as on fish and mammals (Gumpect 1999). Before Spanish settlement of the area at least 45 Gabrielino villages were located near the River, concentrated in the San Fernando Valley and the Elysian Valley, in what is present-day Glendale.

The natural path of the River was historically relatively unstable. In the 18th and early 19th centuries, the alignment of the River ran southwest downstream of the Glendale Narrows (near present-day downtown Los Angeles), where it joined what is now Ballona Creek, and the River discharged into Santa Monica Bay in present-day Marina del Rey; this course is drastically different than the River’s alignment today (Gumprecht 1999). During a large flood in 1825, the River’s course diverted itself to approximately its present one, flowing due south just east of downtown and discharging into San Pedro Bay (Gumprecht 1999; Dark et al. 2011). Between 1825 and the “Great Flood” of 1862, the River was joined by the San Gabriel River in present-day Long Beach, but in 1862 the San Gabriel River carved out a new course 6 mi to the east, and has discharged into Alamitos Bay ever since.
Figure 2. Watersheds and tributaries of the Los Angeles River (figure taken from the Los Angeles River Ecosystem Restoration Integrated Feasibility Report/2014 Draft EIS/EIS)
Until the completion of the Los Angeles Aqueduct for the importation of water, the River was the primary agricultural, industrial, and domestic water source for the Los Angeles region, through River surface water diversions and groundwater pumping. Floods continued to affect the partially developed floodplain areas along the River into the 1930s, leading to calls for additional flood damage reduction measures. The Corps then began a project of channelizing the River. Since completion of this project, the River has served primarily as a flood channel. The only portions of the River that are not both completely channelized and covered with hard structures are: a flood-damage reduction basin behind the Sepulveda Dam near Van Nuys; an approximately 3-mi stretch east of Griffith Park (the Glendale Narrows Project area, where groundwater levels continue to mostly be at the ground surface) where the channel is unlined (soft-bottomed) and along the last few mi of the River in Long Beach where the channel is also soft-bottomed. Treated wastewater from three wastewater reclamation plants currently increase surface flows in the River, starting at the Sepulveda Basin.

Based on past accounts, the River’s surface flow through the Project area was historically perennial (Crespí 2001; Gumprecht 1999; etc.), although common current perceptions are often that it was naturally intermittent or that the River was normally “dry” (e.g., see Smith 2013). For example, Juan Crespí reported considerable surface flow of the River near what is now downtown Los Angeles in the mid-summer of 1769 (Crespí 2001), and significant perennial surface baseflows were consistently reported in the Project area of the River throughout the 19th century (Gumprecht 1999). Portions of this surface water was consistently diverted from the Project area of the River in all seasons during the late 18th and 19th centuries as the primary source for regional irrigation and domestic use in the “Zanja” ditch water distribution system; this canal-ditch water supply was key to the early agricultural and urban development of the area (Gumprecht 1999).

The natural year-round surface water flow of the River in the Study Area was predominately from surfacing groundwater continually draining the large upstream groundwater basin that underlies the San Fernando Valley (Gumprecht 1999). The River’s surface flow was reportedly historically intermittent in stretches upstream of the Project area in the San Fernando Valley and downstream of downtown (Gumprecht 1999).

The first written description of the inland River was made by Juan Crespi during the Portola Expedition in summer of 1769, as they explored the area around what is now downtown Los Angeles (Crespí 2001):

\begin{quote}
Wednesday, August 2—On going three hours, in which we must have made about three leagues as well, we came to the water found by the scouts yesterday, another river with another very green lush valley in no wise inferior to the two past ones [noting the San Gabriel and Santa Ana rivers to the south]; rather, of all of them, I should say that this one bears away the prize. This river here [the Los Angeles River] is a bit smaller than the last ones, its bed being where we crossed about some seven yards wide. It is not deep. It flows from the north-north west, from the quite high mountains lying next by here; while by the same mountains, there is a dry creek [the Arroyo Seco] to the northeast, with a very large bed, closing with the river here; it is plain what large torrents this must carry in
\end{quote}
the season, with many dead trees that must have come down from the mountains. The beds of both are lined with large trees, sycamore, willows, cottonwoods, and very large live oaks….The river flows on down nearly at ground level through a very green, lush, wide-reaching valley of level soil some leagues in extent….upon one and the other side of the river, which runs continually onward [downstream to the west] with a great amount of trees, lie very large, very green bottomlands, looking from afar like nothing so much as large cornfields…The waters of all three rivers are very fresh and pure, and in point of flow this one here is very slightly less than the other two…There are a great many [pronghorn] antelopes at all of these rivers, and very large hares, the latter especially here at this spot.

Today the mostly-concrete channel of the River continues to carry a relatively constant low-flow through much of the region (LARRC 2011). Some of this flow comes from water reclamation plant discharge and street runoff. A substantial portion of the treated water in the River flows from the Donald C. Tillman Water Reclamation Plant (WRP), located upstream of the Project area adjacent to the Sepulveda Basin Wildlife Reserve. The Tillman WRP adds approximately 60 million gallons of reclaimed water to the River each day. Additional treated discharge runs to the River from the Burbank WRP, the Los Angeles/Glendale WRP in North Atwater, and the Whittier Narrows WRP on the Rio Hondo tributary.

Over the last 150 years the River has been substantially degraded by water diversions, agriculture and development within its watershed and floodplain, and channelization of almost all of its floodway. Urbanization of the watershed has deprived the River of needed sediment for riverine and riparian ecosystem function, while also degrading water quality. Like most other larger coastal Los Angeles County streams, the watershed of the River is now heavily urbanized. Much of the River’s original watershed land surface is now underneath impermeable surfaces such as pavement and buildings. As a result, rain runoff now enters the River faster—making the River storm flows “flashier” (increased flood flow peaks and short-term volumes for a given rainfall event). In the 1920s and 1930s, substantial flood events damaged many structures on large developed portions of floodplains in southern California; the River flood of 1938 was one of the most famous flooding episodes of this period.

The state and Federal governments have been building dams, debris basins, bridges and channel structures on the River for more than 70 years to reduce the human impacts from recurrent flooding. The primary purpose of the River has been flood damage reduction since Congress made that declaration in the Flood Control Act of 1936 and five years later authorized the Corps to build and operate major flood-control facilities. When concrete channelization of the River began during the 1930s Depression, it was a national era of big public works projects that produced jobs. Major flood damage reduction projects on the River culminated in the mid-20th century with a Federal flood risk management project, the Los Angeles County Drainage Area project (LACDA project). The River has been completely channelized though its lowland reaches; the LACDA project channelized and lined the River in concrete banks and a mostly concrete bed and straightened/shortened the River’s course (Garrett 1993).
The combination of flood damage reduction projects eliminated most of the riverine and riparian natural communities along the River, greatly reducing its plant and wildlife diversity and numbers. The combination of channelization and surrounding development also essentially eliminated the landscape linkages and corridors of the River to surrounding ecosystems such as the Santa Monica Mountains. The entire River corridor is now heavily degraded ecologically.

Apart from the Sepulveda Basin, the San Fernando Valley area of the River (upstream of the Study Area) is characterized by large segments of channel that are entirely concrete-covered, with dense adjacent development of the former floodplain; this has created substantial challenges for adjacent land acquisition that would be necessary for River widening and restoration in this stretch. The lower reaches of the River (downstream of the Study Area) are also highly constrained by development, including downtown Los Angeles and an adjacent heavy industrial corridor that also includes a major powerline transmission corridor and a freeway system along the River. The reaches of the River above and below the Study Area also have lower potential to connect to regional ecological “core areas” (e.g., the Santa Monica Mountains) because of this dense surrounding existing development, as compared to the Study Area.

A decision by the U.S. Environmental Protection Agency in 2010 reversed an earlier decision by the Corps and recognized the River as a navigable waterway. Several projects have been implemented on the River recently, and more are planned: for example, the 32-ac Chinatown-Cornfields site north of downtown Los Angeles was originally slated for industrial development but has become the Los Angeles State Historic Park. The Los Angeles River Revitalization Master Plan has identified more than 240 potential projects to increase recreation and public access all along the River and to provide some ecological enhancement and restoration along the River (City of Los Angeles 2007).

Study Area

The Corps in the 2013 Draft EIS/EIR identifies the Study Area as the “ARBOR Reach” of the River. The 11.5-mi Study Area stretch of the River stretches from approximately Griffith Park (City of Burbank) downstream to downtown Los Angeles (see Figure 1). The Study Area is dominated by a portion of the River that was altered and engineered as part of the Corps’ LACDA project. The principal River tributaries of the Study Area include Burbank Western Channel, Verdugo Wash, and Arroyo Seco (see Figures 1 and 2).

Despite its highly degraded condition, the ARBOR reach of the Study Area has higher potential for restoration along the River than the other reaches because it includes the Glendale Narrows, one of the few reaches in the River with a non-concrete (soft-bottom consisting mostly of cobblestones) bed and relatively natural perennial River baseflows fed by surfacing groundwater. The Glendale Narrows currently supports some of the only remaining riparian and freshwater marsh natural communities on the River. These existing riparian and marsh areas and the perennial baseflow maintain one of the most diverse assemblages of wildlife remaining on the River today. The Study Area portion of the River has connections to the tributaries of Verdugo Wash and Arroyo Seco; these are channelized streams that could eventually (with substantial
restoration) provide ecological linkages or corridors to significant ecological areas; additionally, the Study Area reach has potential for corridors to relatively large natural areas in Griffith Park).

Griffith Park covers over 4,000 acres at the eastern end of the Santa Monica Mountains, and supports various natural community types (chaparral, coastal sage scrub, oak-walnut woodland, riparian), with southern mixed chaparral as the dominant form, as well as exotic and ornamental vegetation. Its topography is rugged, with elevations ranging from 384 ft to 1,680 ft, including deep canyons, rocky outcrops and escarpments, perennial and ephemeral streams, and portions of the River in the Study Area. Land use in the park is overwhelmingly dominated by recreation, with no area of the park formally protected for ecological preservation. However, the ruggedness of the topography has kept human disturbance minimal over large areas of the park's interior. Although Griffith Park lies within the Santa Monica Mountains Range, it, along with an adjacent block of privately-held open space north of the Hollywood Reservoir, is relatively isolated from undeveloped areas in the main part of the range by urbanization. Griffith Park and this adjacent open space is bordered by Burbank and the 134 Freeway to the north, Glendale and Interstate-5 to the east, Los Angeles to the south, and by a variety of urban land uses, including the 101 Freeway, to the west (Remington and Cooper 2009).

The existing open bed portions of the River, existing natural communities, and perennial surface flows in the Study Area provide a base for enhancement and partial restoration. Additionally, some of the railroad facilities along the River in the Study Area have been abandoned or removed, providing increased opportunity for widening the channel and restoring former floodplain in these areas while maintaining existing flood capacity levels for the River.
Reaches

Figure 3. Aerial photo of a portion of Reach 1 of the Study Area

Reach 1: Pollywog Park/Headworks to Midpoint of Bette Davis Park
Reach 1 is the furthest upstream segment of the Study Area and is about 1.5 mi in length. The reach runs west to east, adjacent to and near the Pollywog Park area of Griffith Park and the Corps Headworks project site. In this reach the River channel is a rectangular concrete-lined configuration with subdrains and no low-flow channel (a low-flow channel is located in the bottom center in the other, all-concrete reaches of the Study Area). A small temporary dam exists within the River bed near the upstream end of this reach that was once used to divert River surface water to the Headworks spreading grounds that were operated by the Los Angeles Department of Water and Power for many years to percolation River surface water to supply domestic water use. The channel in this reach is approximately 18 feet (ft) deep and the top of bank to top of bank width is approximately 115 ft.
Reach 2: Midpoint of Bette Davis Park to Upstream End of Ferraro Fields

This reach is approximately 0.8 mi in length and extends from the midpoint of the Bette Davis Park to the Ferraro Fields, a public soccer field facility. In this reach the River bed transitions from concrete-lined to a cobblestone bed, and then transitions back to concrete. The channel has a trapezoidal configuration with grouted stone banks. The banks are toed-down (secured by extending the bank wall below the river bed) with sheet pile and quarry run stone. The bed is approximately 18 ft deep from the top of banks and approximately 175 ft wide. Sediment deposited in the channel has formed sand bars/islands partially stabilized by vegetation. This reach is not as densely vegetated as the River bed areas farther downstream in Reaches 4 to 6.
Reach 3: Ferraro Fields to Brazil Street
This reach is approximately 1.0 mi in length. It begins at the upstream edge of the Ferraro Fields where the River bed transitions from cobbles to concrete. The River alignment makes an approximately 90-degree curve to the south around Griffith Park and the bed transitions back to cobbles at approximately Brazil Street. The channel in this area is trapezoidal and concrete lined. The bed is approximately 18 to 23 ft deep from the top of bank and approximately 180 ft wide, widening to 380 ft just downstream of the Verdugo Wash confluence. State Route (SR)-134/Ventura Freeway crosses the River at Verdugo Wash.
Reach 4: Brazil Street to Los Feliz Boulevard
This reach of the River is approximately 1.8 mi long and extends from Brazil Street on the left bank downstream to the Los Feliz Boulevard Bridge. The River bed in this reach transitions from a concrete-lined rectangular channel to a trapezoidal channel with a cobble bed and grouted stone banks. The banks are toed-down with sheet pile and quarry run stone. The bed was constructed approximately 18 ft deep from the top of the slope, and the channel ranges from approximately 130 to 160 ft wide at the bank tops. Sediment deposited in the channel over time has formed sand bars/islands that are partially stabilized by vegetation. This reach ends at the Los Feliz Boulevard Bridge, where localized concrete lining of the bed and banks, plus pier noses that extend upstream, have been constructed to protect the bridge.
Reach 5: Los Feliz Boulevard to Glendale Freeway

Within this approximately 1.6 mi reach the River alignment flows east between Hyperion Ave. and SR-2/Glendale Freeway. The reach extends from the Los Feliz Boulevard Bridge, under the Sunnynook pedestrian bridge and the Hyperion Ave. Bridge, downstream to the Fletcher Drive Bridge and ends at the SR-2 Bridge. The River bed transitions from concrete under each of the large bridges (e.g., Los Feliz Boulevard, Hyperion Ave.) to a trapezoidal channel with a cobblestone bed and grouted stone banks between the bridges. Banks are toed-down with sheet pile and quarry run stone. The bed is approximately 18 ft deep and the channel at the bank tops is approximately 130 to 160 ft wide. Sediment deposited in the channel over time has currently formed bars that are somewhat stabilized by the root systems of vegetation. This reach ends as the River alignment begins to curve back east as it approaches Taylor Yard.
Reach 6: Glendale Freeway to I-5 Freeway
This reach is approximately 2.3 mi long and flows through three bends of the River. The reach extends from the SR-2 Bridge to the downstream crossing of Interstate 5 (I-5), where the River bed transitions from cobblestone to concrete-lined. Here the channel is in a trapezoidal configuration with a cobble bed and grouted stone banks. The banks are toed-down with sheet pile and stone. The bed is approximately 30 ft deep from the top of the slope and the top of the channel ranges from approximately 190 to 215 ft wide. Sediment deposited in the channel has formed bars that have become partially stabilized by vegetation. The channel narrows to 170 ft wide and transitions to a rectangular configuration just upstream of the I-5/SR-110 interchange.
Reach 7: I-5 Freeway to Main Street
This approximately 1-mi-long reach begins at the I-5 Bridge and extends to the Main Street Bridge. The channel in this reach transitions out of the rectangular concrete channel at the confluence with the Arroyo Seco, and becomes a trapezoidal concrete channel that is approximately 30 ft deep, with top of bank widths that range from approximately 150 to 190 ft. Three bridges cross the River in this reach, including a railroad bridge, the North Broadway Bridge, and the Spring Street Bridge. The channel has adjacent rail lines on both banks.
Reach 8: Main Street to First Street
This approximately 1-mi-long reach is the most downstream portion of the Study Area: it begins at the Main Street Bridge and extends downstream to the First Street Bridge. The trapezoidal concrete channel in this reach is approximately 30 ft deep with top of channel widths that range from approximately 170 to 200 ft. Rail lines run adjacent to the channel along both banks, and two railroad bridges cross the River. Bridges for US-101 cross the River between César Chávez Ave. and First Street.
PROPOSED PROJECT PURPOSE

The primary purpose of the proposed Project Alternatives considered in the 2013 Draft EIS/EIR is to ecologically restore approximately 11 mi of the River from Griffith Park to downtown Los Angeles (known within the 2013 Draft EIS/EIR as the ARBOR reach) by reestablishing riparian strand, freshwater marsh, and aquatic natural communities and reconnecting the River to major tributaries, its historic floodplain, and the regional ecological zones of the Verdugo Hills and Santa Monica and San Gabriel mountains while maintaining existing levels of flood risk management (Figure 1). A secondary purpose is to provide recreational opportunities consistent with the restored ecosystem. The ARBOR reach provides the backbone for restoring significant habitats and reconnecting the River to other vital ecological areas. Expansion of riparian and marsh natural communities along this portion of the River and at the confluences of key tributaries is considered a first step in putting the portions of the once vast riverine ecosystem back together (USACE 2013a).

DESCRIPTION OF PROPOSED PROJECT ALTERNATIVES

Four Project action alternatives in addition to the No Action Alternative compose the array of proposed plans; these proposed alternatives received detailed analysis in the Corps’ 2013 Draft EIS/EIR. Under the No Action Alternative, human intervention and activities associated with urban development would likely continue to further degrade the ecosystems in the Study Area. Alternative 20 is the Corps preferred alternative and recommended plan (USACE 2014c).

Alternative 10 is described by the Corps as a minimally-acceptable alternative that would increase aquatic community connectivity through riparian corridors and daylighted streams by providing restoration measures on a total of 528 ac. In Reach 1, riparian corridors would be restored on both sides of the channel with connections under Highway 134 to the Pollywog Park Area of Griffith Park, which would be restored with riparian vegetation. In Reach 2, the restored riparian corridor would continue on both sides with connectivity to Griffith Park and subsequently the Santa Monica Mountains. Reach 3 would daylight currently confined streams and would restore riparian and freshwater marsh vegetation on the east bank of the River. A single daylighted stream would be restored on the west bank of the River. Reach 4 would be restored with: a riparian corridor on the east bank of the River, a riparian side channel along the edge of the Griffith Park Golf Course with an inlet and outlet to the River under the I-5 freeway, a riparian side channel through Los Feliz Golf Course, and several daylighted streams. In Reach 5, the riparian corridor would continue on the east bank and would include a daylighted stream at the downstream end. In Reach 6, the channel would be widened by approximately 80 ft along the Taylor Yard site with a small terraced area in the “Bowtie” parcel. In addition, the channel banks would be vegetated with overhanging vines and implanted vegetation. Restoration would be continued in Reach 7 with daylighted streams on both sides of the channel. In Reach 8, the Piggyback Yard site would be restored with riparian vegetation and a historic wash. The restored site would be artificially hydrologically connected to the River, allowing stream flows from the restored ephemeral wash to enter the River through culverts under the existing railroad tracks. The restoration plan for Alternative 10...
would include minimal River widening at Taylor Yard and would exclude restoration at both major confluence areas at the Arroyo Seco and Verdugo Wash.

**Alternative 13** would include most of the features in Alternative 10 (restoration of the historic wash at Piggyback Yard, terracing at the Bowtie Parcel, and restoration of side channels, riparian corridors, and daylighted streams) and restoration of the full Taylor Yard site and the Arroyo Seco tributary. Additional restoration would occur in 3 reaches. In **Reach 3**, a riparian side channel would be restored at the Ferraro Fields site. This riparian channel would connect to the River upstream of the Ferraro Fields site and would re-enter the River through a daylighted stream and marsh area at the downstream end of Ferraro Fields. In **Reach 6**, additional widening of over 300 ft at the Taylor Yard site would be implemented (compared to Alternative 10); restoration of the floodplain and freshwater marsh would occur in the widened channel area. In **Reach 7**, restoration of the Arroyo Seco confluence with riparian and wetland vegetation would be implemented, with some nodal connectivity to the Arroyo Seco watershed and San Gabriel Mountains. Restoration would be accomplished through removal of concrete, softening of the River bed and banks, and development of riparian vegetation at the tributary confluence and for 0.5 mi upstream along the Arroyo Seco. This alternative would support regional connectivity through the River from the Santa Monica Mountains (via Griffith Park) to the San Gabriel Mountains. Instead of the daylighted streams included in Reach 7, as in Alternative 10, the banks of the River downstream from the Arroyo Seco would be lined with overhanging vines and implanted vegetation. **Alternative 13** would provide restoration measures on an additional 60 ac compared to Alternative 10, for a total restoration of 588 ac, and it would increase regional nodal connectivity for wildlife through restoration measures at the Arroyo Seco confluence.

**Alternative 16** would include the features of Alternative 13 and implement additional restoration measures in reaches 5 and 8. It would also remove concrete from portions of the bed of the River. Additionally, the existing concrete bank would be removed between the River and Piggyback Yard. This alternative would widen **Reach 5** along the west bank of the River, modifying the trapezoidal bank to a vertical wall, and would add vegetated terracing on the east bank of the River. In **Reach 8**, additional restoration would be implemented by terracing upstream of Piggyback Yard on the west bank, and through removal of the concrete east bank and the concrete bed in the River adjacent to Piggyback Yard for 0.75 mi. The channel bed would be naturalized to support freshwater marsh in the River and through the restored Piggyback Yard adjacent to the River. The River would be widened in Piggyback Yard by 500 ft on a low terrace and another 1000 ft on a second, higher terrace. Another set of vegetated terraces would be constructed along the east bank of the River downstream of Piggyback Yard. **Alternative 16** would provide restored features on an additional 71 ac compared to Alternative 13, for a total restoration of riparian/wetland features on 659 ac, and it would increase local nodal connectivity through removal of concrete between the River and Piggyback Yard.

**Alternative 20** would include elements of Alternatives 10 and 13/16, with additional features in reaches 2, 3 and 7. It would include restoration measures in the Verdugo Wash confluence and the Cornfields site. In **Reach 2**, the River channel would be widened on the west bank by modifying the trapezoidal bank to a vertical wall. In **Reach 3**, **Alternative 20** would soften the
concrete bed of the Verdugo Wash and widen its mouth at the confluence with the River to support riparian community vegetation and to expand regional connectivity to the Verdugo Hills. In Reach 7, daylighted streams that are described in Alternative 10 would be re-established in lieu of the channel bank vegetation features that were described in Alternatives 13 and 16. Also in Reach 7, freshwater marsh would be restored at the Los Angeles State Historic Park (a.k.a. Cornfields site) with a terraced connection to the River. In Alternative 20, some degree of channel naturalization and restoration would be accomplished in nearly all Study Area reaches and both major River confluences (Arroyo Seco and Verdugo Wash). Alternative 20 would restore features on an additional 60 ac compared to Alternative 16, for a total restoration of riparian/wetland features on 719 ac, and it would increase local and regional nodal connectivity through restoration at the Cornfields site and the Verdugo Wash confluence.

Below is a modified version of a table provided to the Service by the Corps for evaluation purposes.

Table 1. Project Alternatives Summary

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<th>Project Reach</th>
<th>Proposed Conservation Measures</th>
<th>Proposed Project Alternatives</th>
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<tbody>
<tr>
<td>1. Pollywog Park area of Griffith Park</td>
<td>Riparian corridors</td>
<td>X</td>
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<td></td>
<td></td>
<td>X</td>
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<td>2. Bette Davis Park area of Griffith Park</td>
<td>Restructure top of bank to support vines</td>
<td>X</td>
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<td>Riparian corridors</td>
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<td></td>
<td>Modify trap channel to vertical banks</td>
<td>X</td>
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<tr>
<td>3. Ferraro Fields area of Griffith Park</td>
<td>Create pool &amp; riffle system and plant freshwater marsh</td>
<td>X</td>
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<tr>
<td></td>
<td>Daylight streams and plant riparian fringe and freshwater marsh</td>
<td>X</td>
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<td></td>
<td>Divert flow into side channels with riparian fringe and then return flow to the River</td>
<td>X</td>
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<td></td>
<td>Riparian corridors</td>
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<td></td>
<td>Open water restoration</td>
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<tr>
<td></td>
<td>Widen River mainstem</td>
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<td></td>
<td>Widen tributaries</td>
<td>X</td>
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<tr>
<td>4. Griffith Park</td>
<td>Create pool &amp; riffle system</td>
<td>X</td>
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6 Alternative 20 is the Corps preferred alternative and recommended plan.
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<td>and plant freshwater marsh</td>
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<td>Daylight streams and plant</td>
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<td>Riparian corridors</td>
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<td>5. Riverside Drive</td>
<td>Create pool &amp; riffle system</td>
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<td>and plant freshwater marsh</td>
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<td>Wildlife access from River</td>
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<td>to bank (in daylighted streams)</td>
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<td>Terrace banks</td>
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<td>Modify trap channel to</td>
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<td>6. Taylor Yard</td>
<td>Create pool &amp; riffle system</td>
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<td>vines and other vegetation</td>
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<td>Widen channel mainstem</td>
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<td>Widen channel sloping or</td>
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<td>terracing back to overbank</td>
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<td>levels</td>
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<td>7. Arroyo Seco/</td>
<td>Create pool &amp; riffle system</td>
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<td>Los Angeles State</td>
<td>and plant freshwater marsh</td>
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<td>Historic Park</td>
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USFWS Revised Final Fish and Wildlife Coordination Act Report, January 2015
Proposed Los Angeles River Ecosystem Restoration Project
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<td>8. Piggyback Yard</td>
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<td>Riparian corridors</td>
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<td>Widen channel (Arroyo Seco)</td>
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<td>Terrace banks</td>
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Supplemental Proposed Project Commitments and Information (Provided by the Corps in November 2014; USACE 2014c and USACE 2014d)

The Corps’ intent is that Alternative 20 will provide large restored widened areas (such as Verdugo Wash, Taylor Yard, LATC (a.k.a. Piggyback yard)) to serve as riparian habitat patches with natural hydrology. Vegetation and habitat elements in these widened areas will be restored with the goal to support a large number of territories for various riparian obligate birds, including least Bell’s vireo, yellow warbler, and yellow breasted chat, stop over habitat for migrants, as well as habitat and refugia for amphibians, reptiles, and mammals, including larger carnivores such as coyote and possibly bobcat. River channels in widened areas will be designed to support habitat for Santa Ana sucker and Arroyo Chub. These restored widened patches will be connected in part via existing soft bottom reaches 2, 4, 5, and 6 and restored in-channel habitat in Reach 8.

In existing hard-bottom reaches 1, 3 and 7, opportunities for connectivity may be possible through use of anchored boulders and a new meandering low flow channel on top of the existing concrete, which would provide pockets of aquatic vegetation to support movement of wildlife and refugia for native fish. Such opportunities will be explored during the detailed design phase, including "speed bumps", perpendicular to flow, that
can trap sediment and allow small to moderate sized vegetation to grow, as well as a new v-shaped low flow channel with varying widths and depths. These features would be designed to support passage of Santa Ana sucker and Arroyo chub. Installation of these features would entail filling in the existing low flow channel. The remainder of the existing trapezoidal main channel would remain unaltered.

These design ideas, to be further explored during the detailed design phase, will be documented in the Corps’ Final Integrated Feasibility Report (IFR).

Wildlife movement on a regional scale is expected to be accommodated to Griffith Park via wildlife use of existing equestrian tunnels in Reaches 1 and 4. Recent studies using wildlife cameras indicate tunnels have been used by coyote and deer, with one bobcat sighting. Other species that could use the tunnels, if presence of appropriate habitat were available surrounding them, include raccoons, skunks, and gray foxes. Future opportunity for movement to further open space areas such as the Verdugo and San Gabriel Mountains is provided via restoration of the confluences of the Verdugo Wash and Arroyo Seco. Restoration upstream on the remainder of these tributaries is needed via additional projects to complete the connection between the River and these mountainous areas.

Text added to the IFR will include the following:

“In widened areas, habitat will be restored for native fish including Arroyo Chub and Santa Ana Sucker. This will include restoration of the necessary constituent elements to support these species including but not limited to water shaded by riparian vegetation, riffle/run/pool/glide sequences and refugia, in channel woody debris, gravel and cobble substrates. In concrete reaches, aquatic connectivity may be achieved by installation of anchored boulder clusters and reconfiguration of the low flow channel. This will restore sinuosity of the low flow channel and provide some refugia for native fish between widened areas. Details of these features will be considered and evaluated during the project’s detailed design phase. The Corps will continue to coordinate with the Fish and Wildlife Service during detailed design to ensure these elements are included.”

“Design features and directed restoration measures specific to certain species will be added in the detailed design phase and accommodated wherever possible, in coordination with USFWS. It is expected that while these features can be installed artificially during restoration activities, many of these features will also evolve naturally over time as vegetation matures and natural hydrologic forces continue to shape the hydrology widened areas. These features may include, but are not limited to, nest cavities (which could be used by wood duck, barn owl, tree swallow, and western bluebird among other species), large hollow snags (used by swifts), and steep sandy banks (used by northern rough-winged swallow and belted kingfisher).”

1. To demonstrate the Corps’ intent for restoration features to be self-sustaining, with minimal O&M and temporary irrigation, the following text will be added to the IFR.
General location for text addition – Chapter 4 on description of alternatives, Chapter 7
“Temporary irrigation will be used to establish restored vegetation in widened and overbank areas, after which vegetation is expected to be self-sustaining, requiring minimal O&M and relying on groundwater and surface flows to persist. Temporary irrigation will also be used to establish vegetation in the concrete channel walls. Detailed design will identify all water sources to support the proposed vegetation in the concrete channel walls, including surface flows and runoff that may be redirected to sustain this vegetation and avoid permanent irrigation. During extreme drought supplemental water may be used to protect the investment in the restored vegetation.”

*In addition, measure 4a (section 4.4.5) will be revised to delete “permanent irrigation”.*

2. To demonstrate the Corps’ intent to provide wildlife access and facilitate wildlife movement through the project footprint, the following text will be added to the IFR.

General location for text addition - Chapter 6 on connectivity
“Measures for wildlife access are described in Section 4.4.5, measures 3a-c. Specific features for wildlife access will be further defined during the detailed design stage. Movement for bobcats will be the standard for design of access, and such designs will be implemented wherever possible. It is expected that wildlife may use the three existing equestrian tunnels in the project area to access the restored river near Griffith Park, and use restored vegetation and in-channel features to move through the project area.

In the recommended plan, wildlife access/passage within the project footprint will be added in the following areas:
-Reach 1 from Pollywog Park into the river channel (measure 3b),
-Reach 3 from Verdugo Wash confluence to upstream edge of soft bottom Reach 4 (surficial improvements),
-Reach 7 from downstream edge of soft bottom Reach 6 to Arroyo Seco (surficial improvements).

The specific features of this access will be further defined during the detailed design phase. With this access/passage, wildlife may move from Griffith Park using the equestrian tunnel in Reach 4 upstream to Verdugo Wash or downstream to Arroyo Seco. Additional restoration of these tributaries outside the project area would facilitate further regional movement in the future. This restoration may be accomplished by other federal, state, or local stakeholders.

The Corps examined whether additional access could be provided in Reach 7 from the river channel into Elysian Park, however this may not be possible based on the many constraints in this area (freeways, railroad, bridges, topography). The Corps will continue to investigate any opportunities in this area during detailed design, where further analysis will examine alternative methods of providing access.”

*Note: In Section 4.4.5, measure 3, the Draft IFR describes that the wildlife access is a measure common to all alternatives, to be added where possible and reasonable. For this reason, specific locations for wildlife access were not originally included in the alternative descriptions as part of the Draft IFR.*
*Note: In Section 4.4.5, measure 3c, the Draft IFR describes that wildlife passage would only be created to connect wildlife to habitat areas, and that it should not connect wildlife to urban areas that would not be beneficial to their survival.*

3. To demonstrate the existing use of equestrian tunnels in the project area by wildlife, the following text will be added to the IFR.

   General location for text addition - Chapter 6 on connectivity
   “Equestrian tunnels near Griffith Park at Reaches 1, 2, and 4 are expected to support
   movement of wildlife to and from the project area. Recent studies using wildlife cameras
   indicate tunnels have been used by coyote and deer, with one bobcat sighting. Tunnels are
   primarily used at night, when human presence is decreased. Other species that could use the
   tunnels, if presence of appropriate habitat were available surrounding them, include
   raccoons, skunks, and gray foxes. Use of these tunnels to move to and from the project area
   supports regional connectivity for wildlife with Griffith Park and the Santa Monica
   Mountains.”

4. To demonstrate connectivity to Griffith Park through Headworks/Sennet Creek tributary, the following text will be added to the IFR.

   General location for text addition - Chapter 6 on connectivity
   “On-going restoration plans at the Headworks site (Corps/City of LA DWP) adjacent to
   Reach 1, as well as the outlet of Sennet Creek (FoLAR/North East Trees) upstream of Reach
   1, will contribute to connectivity between Griffith Park and the LA River project area. Access
   to the LA River from these sites will be available through the existing equestrian tunnel
   downstream of the Headworks site.”

5. To demonstrate that in areas where the trapezoidal channel is converted to vertical walls, the Corps is able to allow vegetation to grow with minimal maintenance and not impact conveyance, the following text will be added to the IFR.

   General location for text addition - Chapter 7
   “Vegetation within the channel has a significant impact on conveyance of the design flood
   within the ARBOR reach. If allowed to grow unchecked under the With-Project Conditions,
   such vegetation could eventually create an adverse condition with respect to flood risk. The
   District plans to adopt a course of action that allows for ecosystem restoration while not
   significantly changing the current level of flood risk management provided by the channel.

   In reaches where the Corps is proposing to construct a vertical wall to replace the
   trapezoidal side slopes, vegetation will be allowed to grow to the extent that it does not affect
   the conveyance of the channel. During the detailed design phase, the Corps will identify the
   methods for measurement to determine impacts on flow conveyance. It is anticipated that
   limitations to vegetation growth will be modest because of the increased conveyance caused
   by changing the wall to a vertical orientation. The Corps will develop an Operation,
   Maintenance, Rehabilitation, Repair and Replacement (OMRRR) Plan in the design phase, in
   coordination with natural resource agencies. The intent will be to codify in the OMRRR the
   minimal need for O&M activities in the restored areas. OMRRRs are enacted after project
   construction in order to keep project features functioning as designed, and it will be
   important to clarify and specify in the OMRRR under what specific conditions maintenance
   will be required in restored areas. In general, this will include required annual inspections
and maintenance, periodic repair and/or replacement of project features, management of invasives, and (rarely, only when necessary) provision of irrigation during drought. Annual monitoring will allow the Corps to evaluate growth of vegetation and its impact to flood conveyance, which will help minimize the frequency of O&M activities.”

6. To demonstrate the ability of proposed features to support aquatic connectivity in hard bottom reaches 1, 3, and 7, the following text will be added to the IFR.

General location for text addition - Chapter 6 on connectivity
“In the recommended plan, opportunities for aquatic connectivity in certain hard-bottom reaches (1, 3 and 7) may be possible through use of anchored boulders and a new meandering low flow channel on top of the existing concrete, which would support pockets of aquatic vegetation and refugia for native aquatic species moving between larger habitat patches in the project area. Target native fish species include Arroyo Chub and Santa Ana Sucker.

Such opportunities will be explored during the detailed phase, including "speed bumps", perpendicular to flow, that can trap sediment and allow small to moderate sized vegetation to grow, as well as a new v-shaped low flow channel with varying widths and depths. These features would be designed to support passage of Santa Ana sucker and Arroyo chub. Installation of these features would entail filling in the existing low flow channel. The remainder of the existing trapezoidal main channel would remain unaltered.”

7. To demonstrate the Corps’ intent to conduct non-native fish/aquatic wildlife removal, the following text will be added to the IFR.

General location for text addition - Adaptive Management Plan Appendix H
“Removal of non-native fish and other aquatic invasive wildlife would be performed in the project area during construction of restoration features and for 5-7 years post-construction to support recruitment of native Arroyo chub and Santa Ana sucker. Reintroductions of native fish could be proposed and performed by other agencies or organizations with expertise in this field. Beyond the 5-7 year post-construction period, with successful establishment of restored vegetation and a self-sustaining system, it is expected that the native species will be capable of resisting intrusion by non-natives.”

8. To present the Corps’ intent to investigate in the detailed design phase the possibility of creating "spring fed" fish refugia, the following text will be added to the IFR.

General location for text addition - Chapter 7
“Considerations for segregation of “spring fed waters” from surface water flows would be made during the detailed design phase. This segregation would be considered to support refugia for fish, where groundwater would feed the refugia while surface flows might bypass such areas. Parameters required for engineering design would include groundwater levels as well as anticipated local fluctuations in groundwater conditions.”

9. To demonstrate to other agencies/entities that sites at the perimeter of the project area that support wildlife movement (i.e. equestrian tunnels) should avoid development (i.e. nighttime lighting, increased human activity), the following text will be added to the IFR.

General location for text additions - Chapter 6 on connectivity and Executive Summary
“In areas where wildlife movement into the project area is supported, such as at the three existing equestrian tunnels near Griffith Park, additional development should be avoided in the immediate vicinity so as not to negatively impact the planned restoration and wildlife movement. Such development would likely increase nighttime lighting and human presence, which may deter wildlife from using these access points.”

10. To demonstrate that in Reach 6 the turf reinforced mats will not restrict growth of vegetation, the following text will be added to the IFR.

General location for text addition - Chapter 7

“In Reach 6, turf reinforced mats would be used to protect against erosion on the west slope. Vegetation growing through these mats would be allowed to grow as large as possible without impacting conveyance. Vegetation is not expected to compromise the integrity of the mat, and would only require maintenance if flood conveyance is impacted. Modeling during the detailed design phase will inform the size of vegetation that can persist without impeding conveyance. The mat would be monitored for tearing, which may create a local scour problem, and may require maintenance around vegetation. Integrity of the mat would be evaluated regularly, where the density and size of trees growing through the mat would be monitored as part of O&M activities.”

11. To demonstrate the constraints of installing a riparian strip in concrete reaches, the following explanation is provided.

In trapezoidal channel reaches with concrete bottoms, it was suggested that the Corps could convert one or both banks (side slopes) to vertical and create a soft-bottom riparian strip either along the wall or in the center of the channel (and keep the remaining section concrete-lined - but with structural enhancements). Kerry Casey put forth at the last meeting with FWS that this may only be possible in Reach 7 and the upper part of Reach 8 because Reaches 1 and 3 were primarily vertical wall reaches already.

For expediency in modeling, we just assumed there were no utility or other constraints and that all sections under bridges could be converted to vertical walls (ignoring any bridge structural constraints). There are no maintenance roads on either side of the channel in Reaches 7 and 8 and there is limited ROW. The channel is concrete-lined trapezoidal with shorter vertical walls on both sides of the upper banks (side slopes). The channel here has a bottom width of 160 ft and is about 30 ft deep. By converting one wall to vertical we could get an additional ~50 ft of width. After some quick model runs, the Corps has concluded this is not a feasible alternative for the following reasons:

1) Even though it may be possible between some of the bridges, it does create adverse conditions at several locations, primarily bridges. Thus it increases flood risks which is a constraint of the study. The Corps would have to leave these sections of the channel unaltered and would have to transition from trapezoidal to vertical and back to trapezoidal sections (using transition ratios of about 10:1). Since some of these bridges are relatively close together, the length of the transitions would eliminate these reaches from channel reconfiguration.

2) The design velocities in Reaches 7 and 8 are about 30 fps. When adding a riparian strip, the design velocities would decrease slightly, but would increase water surface and increase flood risk. Additionally, the velocities during moderate to large events with a riparian strip would still be above 20 fps, which is too high to add a soft-bottom strip due to scour.
potential. A soft-bottom strip would also compromise the integrity of the remaining concrete channel. Even with a lined bottom there is still concern that the strip would be washed out completely even during moderate flows and the reach would remain unvegetated. Ungrouted riprap placed along the bottom would also move during velocities of that magnitude.

As an alternative to the riparian strip, a proposal to create a new low-flow channel on top of the existing concrete with strategically placed and anchored boulders warrants further analysis. Boulder placement options that we can explore during the detailed design phase include "speed bumps", perpendicular to flow, that can trap sediment and allow small-moderate size vegetation to grow. A new v-shaped low flow channel with varying widths and depths could also be explored, or a combination of these features. These features would entail filling in the existing low flow channel. The rest of the existing trapezoidal main channel would remain un-altered.

12. To demonstrate that design features for certain species will be included during the detailed design phase, the following text will be added to the IFR.
General location for text addition - Chapter 7 and Executive Summary

“Design features and directed restoration measures specific to certain species will be considered in the detailed design phase and accommodated wherever possible, in coordination with USFWS. It is expected that while these features can be installed artificially during restoration activities, many of these features will also evolve naturally over time as vegetation matures and natural hydrologic forces continue to shape they hydrology in widened areas. These features may include, but are not limited to, nest cavities (which could be used by wood duck, barn owl, tree swallow, and western bluebird, among other species), large hollow snags (used by swifts), and creation/maintenance of artificial steep sandy banks (used by northern rough-winged swallow and belted kingfisher."

RELATIONSHIP OF THE PROPOSED PROJECT TO EXISTING MASTER PLAN

In April 2007 the City of Los Angeles published the Los Angeles River Revitalization Master Plan (Master Plan); this Master Plan provides general planning guidance for 32 mi of the River that flow within the City of Los Angeles (City of Los Angeles 2007). It provides planning for the enhancement of aesthetic, recreational, flood risk management, and environmental values by creating a community resource, enriching the quality of life for residents and recognizing the River’s primary purpose for flood risk management. This plan and its associated goals, objectives, and design guidelines serves as a guide to the development of subsequent River planning and development efforts. The Master Plan calls for transforming portions of the River for new, multiple-benefit uses, including natural system restoration, treatment of storm water runoff, establishment of a continuous River greenway, and an interconnected network of parks and trails. The Master Plan also calls for the creation of a 64-mile network of trails, parks, and recreation along both sides of the first 32 miles of the River, from the San Fernando Valley to the border of the City of Los Angeles with the City of Vernon, an area home to more than one million people. The goals of the Master Plan are to: a) Revitalize the River, including enhance flood storage and water quality, enabling safe public access, and restoring ecosystems; b) Green the Neighborhoods, including continuous River greenway and extending open space, recreation,
and water quality features into neighborhoods; c) **Capture Community Opportunities**, including making the River the focus of human activity; d) **Create Value**, including improving the quality of life for human residents. The proposed Project was apparently developed based on the Master Plan and reflects its goals and design concepts.

**DESCRIPTION OF BIOLOGICAL RESOURCES**

Historically the River covered a major swath of the Los Angeles River Basin (consisting of the Los Angeles, San Gabriel, and Santa Ana river systems) with alluvial washes, forests, woodlands, thickets, and marshes, depending on location (Garrett 1993; Gumprecht 2001). The lowlands along the River were covered by dense floodplain riparian forests dominated by cottonwoods and willows (Garrett 1993). Marshland that supported cattails and bulrushes (coastal and valley freshwater marsh) occurred in extensive areas where River water ponded/slowed and soils were perennially saturated, particularly downstream of what is now downtown Los Angeles (Garrett 1993; Gumprecht 2001; Dark et al. 2011). The River system historically supported badger (*Taxidea taxus neglecta*), mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), mountain lion (*Felis concolor californica*), and California grizzly bear (*Ursus arctos horridus*) along the lowlands (Bell 1881; Storer 1955; Garrett 1993; Gumprecht 2001; Crespi 2001; USACE 2013a). The last California grizzly bear known in southern California was killed on Big Tujunga Creek, a tributary of the River, in 1916 (Barkley 1993). A wide variety of now rare birds such as California condor (*Gymnogyps californianus*), burrowing owl (*Athene cunicularia*), California gnatcatcher (*Polioptila californica*), yellow-billed cuckoo (*Coccyzus americanus*), bank swallow(*Riparia riparia*), vireo, and willow flycatcher (*Empidonax traillii*) historically utilized the lowland portions of the River and environs (Garrett 1993). At least seven species of native fish historically occurred in the River (Friends of the Los Angeles River 2008). The floodplain forests formerly supported one of the most biologically diverse and abundant ecosystems in southern California (Garrett 1993).

Over 300 species of birds have been recorded on the River (including its estuary) in recent times, and about half of the total recorded birds in Los Angeles County have even been spotted along the channelized portions of the rivers and streams of the County (The River Project 2001). While the list of birds seen on the River is impressive, with the development of the River’s floodplain and adjacent uplands and the channelization of the River itself, the alluvial scrub, cottonwood/willow forests, oak woodlands, and freshwater marshlands were almost totally destroyed. Concomitant with the loss of these natural communities was the functional loss of almost all of the native fish and wildlife species that heavily depended on these systems (Garrett 1993). While small natural community remnants are currently supported in certain portions of the River (including soft-bottom portions within the Study Area), the historic natural communities along the River have been almost entirely eliminated (see Figure 11 below) (Garrett 1993).
Figure 11. Natural community types along the Los Angeles River, 1896 and 2010 (figure taken from the Los Angeles River Ecosystem Restoration Integrated Feasibility Report/2014 Draft EIS/EIS)
The aquatic animal taxa of the River have likely experienced the greatest change, compared to the River’s pre-channelization state, with large-scale replacement of native species (particularly fish and mollusks) with exotic ones (Garrett 1993). Taxa of riparian communities and other wetland associations have also suffered high rates of local extirpation. The vascular plant flora of the lowland portions of the River is highly modified, characterized by Garrett (1993) as 30 percent to 62 percent exotic species. Despite the severe fragmentation of natural communities, the loss of numerous native taxa, and the establishment of many exotic plant and animal species, the River and its tributaries continue to harbor considerable remnant native biota in certain soft-bottom channel areas, flood basins, and unchannelized foothill and montane reaches (Garrett 1993).

The River channel is soft-bottomed in the Glendale Narrows from a point about 600 ft upstream from the Pasadena (110)/Golden State Freeway (I-5) interchange to the vicinity of the Victory Blvd. bridge over the River just west of the Golden State (I-5)/Ventura (134) Freeway interchange (Garrett 1993). The predominant vegetation in the channel in this area is similar over most of this stretch, but is generally sparser upstream from Los Feliz Blvd.

Aquatic Ecosystems

The Mediterranean climate of southern California creates streams that have strong seasonal patterns of water flow: low-flows (or dry at the surface) in the rainless summer and typically high flows in winter and spring in response to rainfall (Moyle and Light 1996). Year to year variability in precipitation in the region is very high, and extended droughts, with low stream flow, are common (Moyle and Light 1996). The native fish fauna of southern California as a consequence is naturally depauperate and highly endemic, with life history adaptations for dealing with extreme conditions (Moyle and Herbold 1987). Today the natural variability in environmental conditions of many southern California streams has been greatly reduced by channelization, dams, and reservoirs; partially as a result, local fish faunas are often dominated by non-native species (Moyle 1976; Herbold and Moyle 1986).

Many invertebrates and fish inhabiting streams in arid regions naturally face conditions that regularly subject subpopulations to local extirpation. In arid southern California, many streams seasonally undergo natural extreme changes in local surface flow, ranging from completely dry during the summer to substantial flooding during the wet winter (Gasith and Resh 1999). These extreme flow fluctuations often have major effects on aquatic invertebrate and fish populations. During the dry season, subpopulations inhabiting intermittent streams either become extirpated, move to other stream sections, or have a resistant stage (such as a diapausing cyst for some invertebrates), while dramatic temporary reductions in population size often result from flooding events (Meffe and Minckley 1987; Gasith and Resh 1999).

Natural extirpation and recolonization cycles of aquatic animals in almost all coastal southern California streams have been altered by human induced changes to natural surface flow regimes and modifications in stream connectivity and refugia. The effects of these changes on ecological (e.g., population) dynamics is poorly explored. For example, many southern California streams that were once intermittent are now perennial, because of agricultural and/or urban runoff and
treated wastewater releases, including what was initially imported water to the watershed. Conversely, water diversions and groundwater pumping have substantially reduced surface low-flows in many (sometime overlapping) areas, with the concomitant conversion of many formerly perennial streams to intermittent. Both diversions/groundwater pumping, and urban/wastewater releases, are substantially occurring or have occurred on the River. Reservoirs/basins created for water storage or flood risk management facilities have altered the natural hydrological and fluvial cycles of most southern California streams; associated dams, artificial open water, and greatly simplified streams through channelization have changed stream connectivity patterns and reduced or eliminated functions for most native riverine species.

Urban runoff is recognized as a major source of contaminants (Characklis and Wiesner 1997; Paul and Meyer 2001), and wetlands can accumulate contaminants over time. Risks to wildlife from contaminant toxicity may be substantial in urban aquatic and wetland environs such as the Study Area portion of the River. Bioaccumulation of contaminants and toxicological effects on wildlife have been documented for wetlands receiving nonpoint source runoff (Ohlendorf et al. 1989; Schuler et al. 1990; Welsh and Maughan 1994; Glenn et al. 1999; Garcia-Hernandez et al. 2001). Impacts can range from increased turbidity to direct toxicity to algae and aquatic plants, wetland fauna including wetland invertebrates, amphibians, reptiles, fish, and birds, resulting in the loss of biodiversity and simplification of the food chain (Wren et al. 1997; Adamus et al. 2001). These impacts have been demonstrated for organophosphates and pyrethroid pesticides (Katznelson et al. 1995; Harris et al. 1998), polycyclic aromatic hydrocarbons (Maltby et al. 1995), polychlorinated biphenyls (Dunier and Siwicki 1993; Wren et al. 1997; Adamus et al. 2001), and heavy and trace metals such as Hg, Pb, Zn, Cu, and Cd (Galli 1988; Yousef et al. 1990, Campbell 1994; Brown and Bay 2006). The presence and relative severity of effects depends on many site-specific factors, such as the wetland type, contaminant loading rates and concentrations, landscape position, hydrology, nature of sediment storage and transport, and structure of the biotic communities (Schueler 2000). In one study, sediment toxicity, chemistry and benthic macroinvertebrate richness were characterized for 21 freshwater urban wetlands and 2 reference sites in southern California; benthic macroinvertebrate species richness was negatively correlated with sediment contamination, suggesting that toxicity may have affected organisms at the base of the food web in some of these wetlands (Brown et al. 2008).

**Freshwater Marsh**

The planning objectives for the Project include restoring an undetermined acreage of the Study Area to freshwater marsh natural community. For this Project, freshwater marsh is noted by the Corps as equivalent to (USACE 2013b): freshwater marsh (pursuant to Holland 1986); and *Arundo donax* semi-natural herbaceous stands (giant reed breaks), *Typha* (*angustifolia, domingensis, latifolia*) herbaceous alliance (cattail marshes), and *Shoenoplectus californicus* herbaceous alliance (pursuant to Sawyer and Keeler-Wolf 2009).

Freshwater marshes are freshwater wetlands that grow in shallow standing or slow-flowing water, or on perennially saturated ground. The vegetation is adapted to an anaerobic soil environment (Kramer 1988). Restoration variables that can affect freshwater marshes include rate of water flow, fluctuations in water level, water depth, water and air temperatures, pH and dissolved salts, depth and nature of bottom sediments, organic content of the water and past
history of the body of water (Holland and Keil 1995). Freshwater marsh typically occurs along the margins of lakes, ponds, and slow-flowing stream channels (Barbour and Major 1977).

Freshwater marsh historically and currently occurs in the Study Area; it typically is dominated by perennial monocots up to 6 ft in height (Kramer 1988). Freshwater marsh normally includes cattails (Typha spp.), bulrush (Scirpus spp.), sedges (Carex spp.), spike rushes (Eleocharis spp.), flatsedges (Cyperus spp.), smartweed (Polygonum spp.), watercress (Rorippa spp.) and yerba mansa (Anemopsis californica) (Barbour and Major 1977; Holland and Keil 1995; Sawyer and Keeler-Wolf 1995). Rooted aquatic plant species with floating stems and leaves also may be present, such as pennywort (Hydrocotyle spp.), water smartweed (Polygonum amphibium), pondweeds (Potamogeton spp.) and water-parsley (Oenanthe sarmentosa) (Holland and Keil 1995). The non-native invasive plant arundo (Arundo donax) also dominates some freshwater marsh areas (USACE 2013b).

Open Water
Open water communities typically are unvegetated due to a lack of light penetration and water depth. However, open water areas may contain suspended organisms such as filamentous green algae, phytoplankton (including diatoms) and desmids (Grenfell 1988). Floating plants such as duckweed (Lemma spp.), water buttercup (Ranunculus aquatilis) and mosquito fern (Azolla filiculoides) also may be present (Holland and Keil 1995). The boundary between open water and emergent wetlands is generally at a depth of about 7 ft (Kramer 1988). Open water areas are often artificial and naturally relatively rare on the River. Open water areas include standing/slow flowing water found in ponds, lakes and reservoirs. The oxygen content of ponded water is usually relatively low due to the small proportion of water that is in contact with the air and because decomposition of organic materials is occurring on the substrates below (Grenfell 1988).

Riparian Ecosystems

Riparian ecosystems border or straddle water bodies including streams, rivers, ponds, lakes, and seeps or springs. As a result, these areas support plants and animals adapted to (at least periodically) wet environments. Riparian vegetation communities grow in strips along rivers in damp soil. These riparian zones link terrestrial and aquatic systems, and play important ecological roles in the landscape for water and nutrient cycling as well as providing habitats for native flora and fauna. Transfers of nutrients, sediment, and coarse organic matter occur between aquatic and riparian zones, affecting both systems. Riparian areas filter out sediments and nutrients, and they usually store water in alluvial soils that may prolong or sustain stream flows later in the summer (Yarnell et al. 2010).

Stream riparian natural communities are formed by the interacting effects of flood frequency and intensity, soil saturation and depth of groundwater table, proximity to the channel, height above low-flow water level, climate (e.g., temperature, humidity, etc.), slope angle, and fluvial processes (e.g., sediment erosion/transport/deposition). In turn, these factors are controlled by low and high water flow levels, sediment availability, channel geomorphology, channel erosion, and channel meandering, which normally produces backwaters, old channels, different flow
gradients and areas of deposition. Where unconstrained, southern California river floodplain riparian zones are resilient, changing shape and extent naturally in response to episodic larger flood flows, as well as in response to natural variations in groundwater levels and surface water flows. However, human modifications of the watershed, floodplain, and/or channel often severely limit this flexibility.

Local factors determining the dominant plant species (and their size and stem density) on a riparian site include duration of soil saturation, soil depth, soil texture, flood frequency/season/duration, water table depth, soil oxygen availability, and fire (Knight 1994; Weixelman et al. 2011). Changes in plant community composition are mostly driven by successional processes in response to disturbance (e.g., natural denudation) and simultaneously by changes in flooding regime and water table, all of which can change the site type and the potential plant communities that can form. Changes in stream gradient, sinuosity, channel width-to-depth ratios, topography and floodplain landform, or soil type (Knight 1994) (as potentially driven by stream narrowing or channelization) produce various riparian landforms and resulting vegetation communities (Friedman et al. 1997). For instance, riparian vegetation composition is altered below dams due to changes in magnitude, duration, and/or frequency of low and high water flow levels below these structures.

Riparian ecosystems are an extremely small component of the landscape (Sands and Howe 1977). Riparian corridors occupy a small proportion of California, but are biologically important far beyond the land area they occupy. As resource-rich “islands” in semi-arid, human-dominated landscapes, they provide ecosystem functions and services related to water quality, microclimate, structural habitats for wildlife and fish, an energy base for the food web, and typically bank stability (Stella et al. 2013). Riparian zones in California naturally show high levels of plant biodiversity, structural complexity, and strong physical controls on plant demographics and community structure (Stella et al. 2013). In the Los Angeles Basin riparian zones historically supported a distinct riparian flora that was adapted to multiple abiotic stressors, including dynamic flooding and sediment regimes, seasonal water shortage, and fire. The most severe human impacts to riparian areas in the Project region are from watershed and floodplain land-use conversion to urban and industrial uses, flood management, streamflow modification and diversion, and exotic species introductions.

More than 225 species of birds, mammals, reptiles, and amphibians depend on California’s riparian natural communities (RHJV 2004). Riparian ecosystems harbor the most diverse bird communities in the arid and semiarid portions of the western United States (Knopf et al. 1988, Dobkin 1994, Saab et al. 1995). Riparian vegetation is critical to the natural function of in-stream ecosystems and aids significantly in maintaining aquatic life by providing shade, food, and nutrients that form the basis of the food chain (Jensen et al. 1993). Riparian vegetation also modifies in-stream communities when downed trees form scour pools and debris-jams important for fish, amphibians, and aquatic insects (RHJV 2004). The National Research

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7 Pools: the deepest locations of a stream reach. The water surface slope of pools at below bankfull flows is near zero. Pools are often located at the outside of meander bends.
Council (2002) concluded that riparian areas perform a disproportionate number of biological and physical functions on a unit area basis and that the restoration of riparian ecosystem functions along America’s waterbodies should be a national goal.

Riparian natural communities in California make up less than 0.5 percent of the total land area, an estimated 360,000 ac of the state (CDF 2002). Yet, studies of riparian natural communities indicate that these communities are very important or essential to ecosystem integrity and function across landscapes (Sands 1977; Johnson and McCormick 1979; Katibah 1984; Johnson et al. 1985; Faber 2003). Consequently, riparian communities are one of the most important natural communities for wildlife in California, such as land birds (Manley and Davidson 1993). Nevertheless, riparian natural communities in California have been drastically reduced over the past 150 years. Today, depending on region, riparian natural communities only cover 2 to 15 percent of their historical acreages in those regions of California (Katibah 1984; Dawdy 1989).

Due to their biological wealth and severe degradation, riparian areas are extremely important natural communities for wildlife conservation and restoration, including migrant and resident birds in the West (Miller 1951, Gaines 1974, Manley and Davidson 1993, Rich 1998, Donovan et al. 2002). California’s riparian communities provide important feeding, breeding, and sheltering areas, as well as over-wintering grounds, migration stopover areas, and corridors for dispersal for many native species. The loss of riparian communities is one of the most important causes of population declines among land bird species in western North America (DeSante and George 1994).

Valley Foothill Riparian
The planning objectives for the Project include restoring an undetermined acreage of the Study Area to what is described as valley foothill riparian strand natural community (CDFG 1988; USACE 2013a). For this Project, valley foothill riparian strand is noted by the Corps as equivalent to (USACE 2013b): southern cottonwood-willow riparian forest and southern willow scrub (pursuant to Holland 1986); and Salix gooddingii woodland alliance (black willow thickets), Salix laevigata woodland alliance (red willow thickets), and Populous fremontii forest alliance (Fremont cottonwood forest) (pursuant to Sawyer and Keeler-Wolf 2009).

Valley foothill riparian is a tree-dominated natural community primarily vegetated by cottonwood (Populus fremontii), western sycamore (Platanus racemosa), and willows (Salix sp.). Forest understory may consist of shrubby willows and mule fat (Baccharis salicifolia) with herbaceous species including sedges, rushes, and mugwort (Artemisia douglasiana) (USACE 2013b). Scrub community areas have less vertical structure, with shorter willows dominant (USACE 2013b). The structure of this natural community has a canopy height of up to approximately 100 ft in a mature riparian forest, with a canopy cover of 20 to 80 percent (CDFG 1988). Most trees are winter deciduous. Lianas (often wild grape [Vitis californica]) frequently provide 30 to 50 percent of the ground cover (CDFG 1988). Herbaceous vegetation constitutes about 1 percent of the cover, except in openings where tall forbs and shade-tolerant grasses occur (Conard et al. 1977). Generally, the understory is impenetrable and includes fallen limbs and other debris (CDFG 1988).
Cottonwood trees in this community usually grow rapidly and can reach large age class sizes in about 20 to 25 years (typically measured since the last large flood denudation event). Shrubby riparian willow thickets may last 15-20 years before being overtopped and shaded out by cottonwoods and other trees. Valley-foothill riparian natural communities typically provide food, water, migration and dispersal corridors, and escape, nesting, and thermal cover for an abundance of wildlife. Many amphibians and reptiles occur in valley foothill riparian systems; some are permanent residents, while others are transient or temporal visitors (Brode and Bury 1985).

Fish and Wildlife

Historic Fish
The River historically had at least seven species of native fish that were relatively common in the inland portions of the River: Pacific brook lamprey (*Lampetra pacifica*), Pacific lamprey (*Entosphenus tridentata*), unarmored three-spine stickleback (*Gasterosteus aculeatus williamsoni*), southern steelhead trout (*Oncorhynchus mykiss irideus*), arroyo chub (*Gila orcuttii*), Santa Ana sucker, and Santa Ana speckled dace (*Rhinichthys osculus*) (Swift and Seigel 1993; Gumprecht 1999). Two of these species, southern steelhead and Pacific lamprey formerly migrated from the sea in mid-winter to spawn in the main River and in its larger tributaries of Big Tujunga Creek and Arroyo Seco; these species spawned both in the lowlands and the mountains, their young spending one to two years in the streams or coastal lagoons before returning to the sea (Swift and Seigel 1993). Five of these native fish species were permanent residents. Four of the resident taxa were endemic to the larger Los Angeles Basin (this includes the Los Angeles, San Gabriel, and Santa Ana River systems combined) and nearby areas (Swift and Seigel 1993). All seven species originally lived the Study Area or within a few miles (Swift and Seigel 1993). Other native fish species possibly included Chinook salmon (*Oncorhynchus tshawytscha*) and Sacramento pikeminnow (*Ptychocheilus grandis*) (Hall and Litton 2008).

Fish habitats in southern California are naturally challenging, including highly variable water flow regimes and high water temperatures (Bell et al. 2011). The Los Angeles Basin has a small but highly endemic native freshwater fish fauna (Swift and Seigel 1993). In comparison, southern California streams to the north and south of the Basin typically have two to four native freshwater fish species (Swift and Seigel 1993). Pacific brook lamprey, arroyo chub, and unarmored three-spine stickleback were common in the lowlands of the Basin in the original streams, springs, and marshes that were present in the Basin; these species did not penetrate far, if at all, into the mountainous tributaries of the Santa Monica and San Gabriel mountains (Swift and Seigel 1993). Santa Ana sucker and Santa Ana speckled dace occurred most widely in the mountainous portions of the drainage; however speckled dace also occurred in a few spring-fed localities and Santa Ana suckers also occurred in the large main river channels (Swift and Seigel 1993).

As urban development expanded across much of the lower elevations of the River’s watershed, populations of native fish declined. For example, steelhead spawning grounds were directly reduced or cut off by dams and road crossings that made fish passage difficult, if not impossible.
Water that is/was diverted or pumped (e.g., groundwater from wells) for agricultural, residential, or commercial use reduces/reduced stream low-flows in the River. In addition, poor water quality from urban runoff likely adversely affects/affected the streams and lagoons necessary for native fish.

All of the native fish species are apparently extirpated from the mainstem (including the Study Area) of River today, although a couple of these native fish species reportedly persist in some of the River’s tributaries (noted below). Native fishes were widespread across the lowlands of the Los Angeles Basin before completion of many flood damage reduction projects in the 1940s (Van Wormer 1991; Swift and Seigel 1993). No native fish species of the River apparently remained extant for more than several years following the channelization of the River that occurred in 1938 (Hall and Litton 2008).

Historically, the River supported a seasonal recreational fishery, mainly comprised of an annual winter run of steelhead trout. As noted, following channelization of the River, steelhead trout and other native species of the fishery disappeared, and were eventually replaced by common carp (*Cyprinus carpio*), tilapia (*Oreochromis* sp.), and other non-native species.

Survival, competition, and effective growth and reproduction of fish is highly dependent on metabolic rates as affected by water temperatures, food availability, available cover, and other factors. Water temperature in turn is affected by several key environmental parameters, including instream flows, riparian vegetation condition, groundwater influence, and channel morphology (Bell et al. 2011). As such, the information below, in part, is provided pursuant to the Project general objective of restoring some native fish habitat to the River and to inform restoration and enhancement designs and decisions for the proposed and other future projects, and to assist in the subsequent management of stream characteristics and parameters within and along the River.

**Pacific Brook Lamprey**

By the time Pacific brook lamprey was a recognized as district from the Pacific lamprey, the former was extirpated and very few specimens had been saved (Swift et al. 1993). Restoration of Pacific brook lamprey to the Study Area is not likely practicable.

Presumably the biology of the Pacific brook lamprey was much like other small species of western nonparasitic lampreys (Swift and Seigel 1993). The Pacific brook lamprey likely lived their entire lives in silty but well-oxygenated sediments, and transformed to adults in the early spring only long enough to spawn (Swift and Seigel 1993). The spawning period in the River probably occurred in late April through early May(Swift and Seigel 1993). It probably was a short lived and possibly an annual species, particularly in southern California (Swift and Seigel 1993). It is also possible that the local form was a distinct species (Hubbs and Porter 1971). It lived primarily, if not exclusively in the lowlands of the Los Angeles Basin and undoubtedly was common in the River (Swift and Seigel 1993).

In the synonymous or likely similar western brook lamprey, spawning adults build nests slightly smaller in diameter than their body lengths in gravel riffles at a water depth of about 5 to 6 in, in
slow (0.7 ft/second) moving water. Median substrate size in western brook lamprey nests is 0.9 in, and most nests are associated with cover (boulder, wood, or vegetation) and found in either pool tail outs or low gradient areas. Upon completion of the nest, adhesive eggs are deposited and covered with sand and gravel. Speckled dace and salmonids (*Oncorhynchus* spp.) feed on the eggs in western brook lamprey nests where they co-occur (Brumo 2006). Once juveniles reach about 10 in in length, they leave the nest and move downstream, usually at night, to burrow into deposits of fine sediments, their mouths towards the substrate surface so that they can filter feed. Ammocoetes (larvae) move further downstream into deeper areas as they grow (Kostow 2002). While they grow they feed on algae (especially diatoms) and organic matter (Wydoski and Whitney 1979).

Pacific brook lamprey in the River probably had similar habitat requirements to that of southern steelhead with which they co-occurred. They likely needed clear, cool water in little disturbed watersheds as well as clean gravel near cover (boulders, riparian vegetation, woody debris, etc.) for spawning. Additionally, they likely needed habitats with slow moving water and fine sediments for rearing. The adults likely avoided areas with deep, fast water and large substrates.

**Pacific Lamprey**

Shortly after hatching in freshwater streams, Pacific lamprey ammocoetes drift downstream into areas of low velocity and fine substrates where they burrow, and live as filter feeders for up to 7 years. Metamorphosis to macropthalmia (juvenile phase) occurs gradually over several months from July to November before their migration to the ocean in the winter and early spring. During this transformation they develop eyes and teeth. As adults in the ocean, Pacific lamprey are parasitic and feed on the body fluids and blood of marine fishes. After spending 1 to 3 years in the marine environment, Pacific lamprey stop feeding and migrate back to freshwater between February and June. They overwinter in fresh water until they spawn the following year between March and July. After spawning, Pacific lamprey die within days. Restoration of Pacific lamprey to the Study Area and environs would be quite challenging and require substantial riverine, riparian, and watershed restoration along the much of the River inside and outside of the Study Area, including fish passage and water quality parameters similar to those needed for restoration of steelhead trout.

**Unarmored Threespine Stickleback**

The unarmored threespine stickleback (“stickleback”) is a small, scaleless, freshwater fish of up to 2 in standard length inhabiting slow-moving reaches or quiet-water microhabitats in streams and rivers (USFWS 2009). Restoration of stickleback to the Study Area would be challenging and require substantial riverine, riparian, and watershed restoration along the much of the River.

Favorable habitats are usually shaded by dense and abundant vegetation. In more open reaches, algal mats or barriers (e.g., sand bars, floating vegetation) may provide refuge for the species. Stickleback feed primarily on benthic insects, small crustaceans, and snails, and to a lesser degree on flatworms, nematodes, and terrestrial insects. Stickleback reproduce throughout the year, with less breeding activity occurring from October to January. Reproduction occurs in areas with adequate aquatic vegetation and slow-moving water where males can establish and vigorously defend territories. The male builds a nest of fine plant debris and algal strands and
courts all females that enter his territory; a single nest may contain the eggs of several females. Following spawning, the male defends the nest including newly hatched fry. Stickleback are thought to live for only 1 year.

Stickleback are currently restricted to three areas: the upper Santa Clara River and its tributaries in Los Angeles County, San Antonio Creek on Vandenberg Air Force Base in Santa Barbara County, and the Shay Creek vicinity (which includes Shay Pond, Sugarloaf Pond, Juniper Springs, Motorcycle Pond, Shay Creek, Wiebe Pond, and Baldwin Lake) in San Bernardino County. San Felipe Creek in San Diego County is another area that may support the stickleback; however, its current status there is unknown. They were historically found in low-gradient portions of the Los Angeles, San Gabriel, and Santa Ana Rivers, and from a few localities in Santa Barbara County, but have been extirpated from these areas. In 1917, the stickleback was reported to be abundant throughout the Los Angeles Basin (Miller and Hubbs 1969) but by 1942, they were no longer found there and were thought to be extirpated. Stickleback were likely extirpated from River as a result of the effects of urbanization, including flood risk management, channelization, dewatering of streams, habitat alteration, introduction of exotic predators, and pollution.

Santa Ana Sucker
The Santa Ana sucker is federally listed as threatened and occupied the Study Area historically, but is very likely extirpated from the Study Area and along the whole mainstem of the River. The Santa Ana sucker is potentially restorable to the Study Area with considerable riverine and riparian modifications to the River, including substrates and water quality parameters as noted below.

The Santa Ana sucker inhabits streams that are generally shallow, with currents ranging from swift (in canyons) to slow (in the bottomlands). All of these streams are subject to periodic severe flooding (Moyle 1976, Moyle 2002). Santa Ana suckers feed mostly on algae, which they scrape off of rocks and other hard substrates, with aquatic insects making up a small component of their diet. Larger Santa Ana suckers generally feed more on insects than do smaller fish (Greenfield et al. 1970; Moyle 1976).

Santa Ana suckers generally live no more than 3 years (Greenfield et al. 1970). Spawning typically occurs from early April to early July (Moyle 2002). Fecundity appears to be exceptionally high for a small sucker species (Moyle 1976). The combination of early sexual maturity, protracted spawning period, and high fecundity likely allows the Santa Ana sucker to quickly repopulate streams following periodic flood events that temporarily decimate populations (Moyle 1976).

Santa Ana suckers historically occurred in low-elevation streams in the Los Angeles, San Gabriel, and Santa Ana River systems (Swift et al. 1993). They also historically occurred in the upper Santa Ana River (Moyle et al. 1995). Introduced populations are present in the Santa Clara River, Sespe Creek, Piru Creek, and San Francisquito Creek. Although historic records are scarce, Santa Ana suckers presumably ranged from near the Pacific Ocean to the uplands of these river systems (Swift et al. 1993). The species has experienced significant declines throughout
most of its range (Moyle et al. 1995; Swift et al. 1993) and is currently restricted to three noncontiguous populations: (1) lower and middle Santa Ana River; (2) East, West, and North Forks of the San Gabriel River; and (3) lower Big Tujunga Creek (a tributary to the Los Angeles River).

Santa Ana suckers were found in the River and larger tributaries usually in rocky and gravelly areas where they grazed algae and diatoms from rocks. They probably spawned in the River in March or April in runs and the lower ends of pools (Swift and Seigel 1993). They historically were known to occur in the Study Area near Griffith Park (Swift and Seigel 1993). A single fish was taken about 2 mi downstream of the Sepulveda Flood Basin in 1949 (Swift and Seigel 1993). Since that time all records for the River drainage are from upstream of Hansen Dam on Big Tujunga Creek (Swift and Seigel 1993).

Nonnative fish such as green sunfish (Lepomis cyanellus) are potential competitors and egg predators that have a deleterious effect on Santa Ana sucker populations. Santa Ana sucker has been extirpated from the upper Santa Ana River drainage, largely because of inadequate flow, poor water quality, and in the lower Santa Ana River likely due to introduced brown trout (Salmo trutta) below Prado Dam (USFWS 2000). The San Gabriel River generally contains a higher abundance of Santa Ana suckers and larger individuals than the Santa Ana River, which could be attributed to more suitable habitat characteristics (as compared to the Santa Ana River) such as cooler water temperatures, intermediate water velocities, and commonality of pools and riffles with coarser bottom substrates, all of which may contribute to a better functioning system and a greater abundance of suitable habitat for Santa Ana suckers (Saiki et al. 2007). Santa Ana suckers prefer cool water temperatures but have been found in some life stages in waters between 59 and 82 deg. F in the Santa Ana River (Swift 2001); they typically inhabit small, shallow streams and rivers less than 23 ft wide where water temperature is generally below 72 deg. F, and where currents range from swift to sluggish (USFWS 2000).

Santa Ana suckers appear to be most abundant where the water is cool, unpolluted, and clear, although they can tolerate and survive for a period in seasonally turbid water (Moyle 1976, Moyle and Yoshiyama 1992, Saiki 2000). Santa Ana suckers are often found in pools; juvenile and adult Santa Ana suckers require deeper pools of water for foraging, shelter during storms, and protective cover. The presence of coarse substrates, including gravel, cobble, and a mixture of gravel or cobble with sand, and a combination of shallow riffle areas and deeper runs and pools provide optimal stream conditions (USFWS 2010). Adults show a strong preference for run habitat and a water depth of 16 in and greater. Juveniles prefer riffle and run habitat, depths greater than 12 in and gravel substrate (Haglund and Baskin 2002). In a study conducted in

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8 Riffles: the sections of the streambed with the steepest slopes and shallowest water depths at flows below bankfull. Riffles typically occur at cross over locations and have a poorly-defined thalweg (deepest part of the channel).

9 Runs: the sections of streambed that often follow riffles and are usually followed by pools. Runs differ from riffles in that the depth of flow is typically greater and slope of the bed is less than that of riffles. Runs will often have a well-defined thalweg.
2002, fry were found exclusively in edgewater habitat over silt at depths of less than 7 in where there was no measurable flow (Haglund and Baskin 2002). Areas of shifting sandy substrates are less suitable for development of algae, an important food source for suckers (Saiki et al. 2007). Gravel beds in shallow, but clear, flowing stream reaches are needed for spawning; Santa Ana suckers spawn over gravel riffles where fertilized eggs adhere to the substrate. As such, an integrated stream system that contains the appropriate quantity of coarse substrates such as gravel, larger cobbles, or boulders that provide the space for reproductive development and growth of algae as a primary food source is important for a viable population of Santa Ana suckers (USFWS 2010).

The systems occupied by these fish undergo flashy, high stream flows that can periodically reduce population abundance and distribution. Natural upstream and downstream movement depends on habitat conditions; flood events often contribute to dispersal of the species (Riverside County Integrated Project 2000).

Native riparian vegetation over water provides cover and shelter from predators, which is normally essential for juvenile and adult Santa Ana suckers (USFWS 2010). Shallow areas with sandy substrates and overhanging vegetation are needed to support larvae and fry. Cooler water temperatures are only maintained in some areas by the upwelling of cooler groundwater, tributary flows, and shade from overhanging vegetation, which reduces water temperature during summer and fall months. Overhanging and instream vegetation are also needed for the development of an aquatic invertebrate community to supply food for adult suckers.

Therefore, in order to support Santa Ana sucker a complex and integrated stream system is needed or restored that:

1. encompasses sand, gravel, cobble, and rock substrates;
2. harbors diverse bed morphologies normally found in canyons and alluvial floodplains;
3. provides cool, clear water of varying depths and velocities, and native riparian vegetation cover;
4. contains tributaries that provide fish with areas of refuge (refugia) from predators and during floods and that can also provide suitable breeding habitat; and
5. harbors sources of coarse sediment for renewal of substrates in occupied areas.

Southern Steelhead Trout
Southern steelhead trout, otherwise known as southern steelhead or steelhead, are a cold water fish and unique form of rainbow trout; southern steelhead are the southernmost native anadromous rainbow trout in North America. Steelhead are federally listed as endangered in Los Angeles, Orange, and San Diego counties (the range of the Southern California Steelhead Distinct Population Segment [Southern California Steelhead DPS] extends to the U.S.-Mexico Border) (NOAA 2012). It is estimated that this Southern California DPS once numbered over 45,000 but has since declined to less than 500 individuals. Steelhead occupied the Study Area historically and are now extirpated from the River and tributaries. Restoration of steelhead trout to the Study Area and environs would be quite challenging and require substantial riverine, riparian, and watershed restoration along the much of the River inside and outside of the Study Area.
Steelhead are one of six Pacific salmon species that are native to the west coast of North America, and are currently the only species of this group that naturally reproduces within the coastal watersheds of southern California. Because steelhead employ several different life-history strategies that exploit all portions of a river system, they serve as a good indicator of the health of southern California watersheds and streams. Southern California Steelhead DPS populations have declined precipitously, largely due to extensive watershed development (NOAA 2012).

Differences between the southern steelhead and those steelhead to the north relate mainly to life history, reflecting the highly variable environment in which these fish evolved (California Trout 2011). Southern steelhead exhibit three basic life-history strategies: fluvial-anadromous (migration between freshwater and saltwater), lagoon-anadromous (migration to and from a brackish lagoon), and freshwater residency (remain in fresh water; resident inland rainbow trout) (NOAA 2012). These three life-history strategies have allowed southern steelhead to take advantage of different habitats and to persist in the highly variable and naturally challenging southern California environment (NOAA 2012). Southern steelhead are dependent on short-duration winter rains to provide passage through estuaries and rivers to the upstream freshwater spawning and rearing habitats of their birth. This results in a restricted and rapid spawning period, so fish are generally mature when they ascend the rivers (California Trout 2011). Because of frequent droughts in southern California, streams may be inaccessible from the ocean during some years, forcing adult steelhead to spend additional years in the ocean (California Trout 2011). During drought years the steelhead in freshwater endure long, hot summers by remaining in pools of deep, cool water (NOAA 2012).

While all steelhead hatch in gravel-bottomed, fast-flowing, well-oxygenated rivers and streams, some individuals (rainbow trout, as indicated above) stay in fresh water all their lives. The steelhead that migrate to the ocean develop a slimmer profile, become more silvery in color, and typically grow much larger than the rainbow trout that remain in fresh water. Some inland trout do migrate for the purpose of spawning or food foraging.

Southern steelhead occasionally attain weights of over 20 pounds (but are usually lighter) (California Trout 2011). They have lifespans up to 11 years and are sexually mature at 2-3 years.

Steelhead eat zooplankton while young; adults feed on aquatic and terrestrial insects, mollusks, crustaceans, fish eggs, minnows, and other small fishes (including other trout). Optimal growth for steelhead occurs at 59 to 64 deg. F, and mortality typically results at 75 to 81 deg. F. Steelhead require near saturation levels of dissolved oxygen to grow, though these fish can survive at levels as low as 1.5-2.0 parts per million (ppm). They do best where dissolved oxygen concentration is at least 7 ppm. In streams, deep, low-velocity pools are important wintering habitats. Steelhead require suitable gravel within stream riffle sections or pool tails, free of excessive silt, to dig nests for spawning. Times spent in freshwater and in the ocean vary according to geography, life history patterns, and effects of natural phenomena.
The female fish digs a redd (nest) and deposits 200 to 12,000 eggs depending upon her body size. After breeding, steelhead rest before moving back out to sea. In 3 to 4 weeks the eggs hatch, and the young trout spend another 2 to 3 weeks under the cover of the gravel before emerging as fry. In some instances the fry of anadromous steelhead will emerge soon after hatching and swim straight to the ocean to avoid dry summer periods. Typically the young steelhead reside in freshwater for 1 to 3 years before smoltification (transition to being able live in salt water). When the smolts finally reach the ocean they begin feeding on invertebrates, krill, and then focus on fish. Steelhead may stay in saltwater for 1 to 2 years before returning to their native streams to spawn. Most anadromous salmonids (e.g., salmon) die after spawning, but steelhead may make numerous trips back and forth between fresh and salt water to breed. Steelhead may spawn up to four times per life span, though the mortality rate between successive cycles is high. Within a stream’s freshwater reaches, steelhead have in-stream habitat preferences generally determined by size. The smallest fish are mostly found in riffles, medium sized fish in runs, and larger fish predominantly in pools.

The primary factors impacting southern steelhead populations in southern California region include: (1) alteration of stream flow patterns, (2) physical impediments to fish passage, (3) alteration of floodplains and stream channels, (4) sedimentation, (5) waste discharges, (6) exotic species, (7) loss of estuarine habitat, and (8) stocking of hatchery reared salmonids (California Trout 2011). Southern steelhead have survived in the region despite the extensive modification of much of their habitat.

Many streams of the region have portions of their watersheds that are currently inaccessible to southern steelhead due to man-made barriers, but were historically used by steelhead. Major southern steelhead watersheds include the Santa Maria, Santa Ynez, Ventura, and Santa Clara Rivers, and Malibu and Topanga Creeks to the north of the River, and the San Gabriel, Santa Margarita, San Luis Rey, San Dieguito, and Sweetwater Rivers, and San Juan and San Mateo Creeks to the south.

**Arroyo Chub**

The arroyo chub is a California Species of Special Concern and has no Federal status. They are found only in the coastal streams of southern California. They probably occupied the Study Area historically, but are likely extirpated. The arroyo chub is likely restorable to the Study Area with considerable riverine and riparian modifications along the River.

Arroyo chub are normally restricted to pools and glides\(^\text{10}\) in low gradient stream reaches (2 percent slope maximum), and they are usually associated with emergent vegetation. Arroyo chub are adapted to survive in streams that fluctuate between large winter storm flows and low summer flows, including the low dissolved oxygen and relatively wide temperature fluctuations (50 to 75 deg. F) associated with this flow regime. They are most common in slow flowing or

\(^{10}\) Glides: the section of streambed located immediately downstream of pools. A glide ends at the upstream end of a riffle or run. The slope of the channel bed through a glide is negative while the slope of the water surface is positive.
backwater stream areas with sand or mud substrate, but may also inhabit areas with velocities in excess of 2.6 ft/second over coarse substrate (University of California 2013). They feed on plants such as algae and water ferns (Azolla spp.), and on invertebrates such as insects and mollusks. In a trial study the arroyo chub was found to be a viable alternative to the exotic mosquito fish (Gambusia affinis) for integrated mosquito management programs in riverine wetlands and sensitive watersheds of southern California within its former range (Van Dam and Walton 2007).

Arroyo chubs reach a size of 3.1 to 3.5 in by their fourth year and rarely live longer than this. Females can reproduce at age 1. Spawning takes place in pools and edge habitat from February to August with a peak in June and July. Fertilized eggs stick to plants or bottom substrate and hatch in about 4 days. Fry stay on the substrate for a few days, then rise to the surface and stay among plants or other cover for 3 to 4 months.

Like the Santa Ana sucker, the arroyo chub is endemic to the streams and rivers of the Los Angeles plain in southern California, including the Los Angeles, San Gabriel, Santa Ana, San Luis Rey, and Santa Margarita rivers, and Malibu and San Juan creeks. They have been extirpated from much of their native range but have been introduced to streams along the coast as far north as Chorro Creek in San Luis Obispo County, California. They have also been introduced to the Mojave River system where they may have eliminated the Mojave tui chub.

Arroyo chub are still found in Big Tujunga Canyon (tributary to the River), the Santa Ana River, Trabuco Creek, San Juan Creek, and Malibu Creek, and are reportedly now common only in Trabuco Creek, San Juan Creek, and Malibu Creek (Swift et al. 1993; WR Biological Monitoring Program 2011; Wilcox 2012). Re-establishment of the arroyo chub was the focus of a recent habitat restoration effort in the City of Pasadena on a remaining soft-bottom stretch of the Arroyo Seco (tributary to the River).

**Speckled Dace**

The speckled dace is a California Species of Special Concern. They probably occupied the Study Area historically, but are likely extirpated. The speckled dace is possibly restorable to the Study Area with substantial measures within the Study Area.

Speckled dace are capable of living in an array of habitat types from small springs or streams to large rivers and deep lakes. Speckled dace prefer habitat that includes clear, well oxygenated water, with movement due to a current or waves. In addition, the fish do well in areas with deep cover or overhead protection provided by vegetation or woody debris. Speckled dace predominantly occupy small streams of the second to third order where they feed and forage for aquatic insects. The species is very adaptable and is found in cold alpine lakes such as Lake Tahoe, but it has also been able to survive adversity in temperatures at or above 88 deg. F with a dissolved oxygen concentration of 2 ppm. In streams speckled dace swim along the bottom looking for small invertebrates while in lakes they are opportunistic feeders that may feed on zooplankton, algae, nymphs, or the resulting flying insects. Speckled dace typically have a life span of three years but may live 6 or more years, during which time females typically grow more rapidly than males. The fish become sexually mature in their second year, and during the summer months the dace spawn. Stream dwellers spawn in riffles or gravelly areas, while the
lakes inhabitants spawn in tributaries or in shallow shoreline regions. The embryos hatch in 6 days, and the larvae remain in the safety of the gravel for 7-8 days. The young fry then spend the early part of their lives in the shallow warm areas of the stream or lake where they hatched.

Speckled dace in the watersheds of the River were found in small to large, often spring-fed, moderate to high gradient rocky to gravelly streams, mostly in the mountainous tributaries farther upstream (Swift and Seigel 1993). The closest recorded population to the Study Area occurred in a small spring-fed stream in North Hollywood last collected in 1939; it was probably never common in the Study Area (Swift and Seigel 1993). It occurred further upstream in Big Tujunga Creek below Tujunga Reservoir until about the mid-1980’s and had not been collected since. It is possibly extirpated in the River drainage, but populations still exist in the San Gabriel and Santa Ana drainages (Swift and Seigel 1993).

The native range of the speckled dace is the drainages of the western U.S. and Canada from the Columbia River (British Columbia) to the Colorado River (Arizona and New Mexico) and south into Sonora (Mexico) (Page and Burr 1991).

**Current Fish**

Fish species currently in the River consist of a variety of non-native species. Of the 1,200 fish caught in a 2008 fish study within the Project area, mosquitofish (*Gambusia affinis*) and tilapia were the most abundant, and common carp, fathead minnow (*Pimephales promelas*), and green sunfish were also common (Friends of the Los Angeles River 2008). The fish caught in this study and one from 1991/1992 (Swift and Seigel 1993) in the Project area were:

- fathead minnow
- common carp
- black bullhead (*Ameiurus melas*)
- Amazon sailfin catfish (*Pteroplichthys pardalis*)
- mosquitofish
- green sunfish
- largemouth bass (*Micropterus salmoides*)
- goldfish (*Carassius auratus*)
- tilapia

Flathead minnow, goldfish, and mosquitofish have been present since the 1950s in southern California drainages, and tilapia have been found in California coastal drainages since the 1990s (Swift and Seigel 1993). Species also known to occur in the River include: bluegill (*Lepomis macrochirus*), brown bullhead (*Ameiurus nebulosus*), and channel catfish (*Ictalurus punctatus*) (Friends of the Los Angeles River 2008).

The only currently approved place to fish on or near the River is at Lake Balboa, within the Sepulveda Basin, which is stocked with rainbow trout, largemouth bass, and other fish species (Los Angeles River Revitalization Corporation 2013). People are reported to fish in the Study Area in accessible River stretches with flowing or standing water.
Black bullheads, green sunfish, and largemouth bass are all currently common in most southern California freshwater streams on the coastal slope, including the Big Tujunga Wash, an upstream tributary of the Project site (Friends of the Los Angeles River 2008). Bullhead catfish (brown and black) are nocturnal predators that prey to some extent on native fish species in other areas of the Project region (Friends of the Los Angeles River 2008). Notably, green sunfish also prey on native fishes and amphibians in places such as Malibu Creek and Big Tujunga Wash (Friends of the Los Angeles River 2008). Green sunfish are probably continually washed down into the Project area from Tujunga Wash and other upstream locations (Friends of the Los Angeles River 2008). During a 2008 fish study a largemouth bass was detected only a single time in the Glendale Narrows portion of the Project area, possibly coming from one of the lakes upstream where they are more common (Friends of the Los Angeles River 2008). Largemouth bass apparently do not do well in strongly flowing streams; they are typically restricted to backwaters and slow moving pools (Friends of the Los Angeles River 2008). Backwaters and slow moving pools are currently quite uncommon in the Project area due to channelization, and this likely restricts largemouth bass and other species with similar life history restrictions in this portion of the River. Notably, largemouth bass also strongly prey on many native fish species in the region (Friends of the Los Angeles River 2008). Many of the exotic fish species detected in the 2008 study are likely better adapted to slower waters than the storm flows that are seasonally present in the Project area, but are nevertheless effectively extant and competitive under current conditions (Friends of the Los Angeles River 2008).

Amphibians & Reptiles
The upper watershed of the River continues to support substantial and intact reptile and amphibian populations. The arroyo toad (Anaxyrus californicus) and California red-legged frog (Rana draytonii) persist on the upper Tujunga Wash and the upper Arroyo Seco tributaries to the River upstream of the Study area.

A total of 12 species of amphibians and 21 species of reptiles are considered to occur now or have occurred in the 20th century within 1 mi of the present channel of the River from Sepulveda Basin to the River mouth (hereafter considered “the channel area”); these consist of 5 salamanders, 7 frogs, 1 turtle, 7 lizards, and 13 snakes. Only one of these, the bullfrog (Rana [Lithobates] catesbeiana), is exotic; the balance of 32 species are herein considered the native reptile and amphibian fauna of the River (Bezy et al. 1993).

Of the native amphibians of the River, four salamanders are considered as occurring or probably occurring within 1 mi of the channel area: Pacific slender salamander (Batrachoseps pacificus) in flatland situations; arboreal salamander (Aneides lugubris), black-bellied salamander (Batrachoseps nigriventris), and ensatina (Ensatina escholtzii) in the foothill area of Griffith Park. Of the 6 frogs/toads of the original native River fauna, only California toad (Anaxyrus boreas halophilus) and Baja California treefrog (Pseudacris hypochondriaca) (and the exotic bullfrog) persist in the channel area. The California treefrog (Pseudacris cadaverina), western spadefoot (Scaphiopus hammondi), arroyo toad (federally listed endangered), and red-legged frog (federally listed threatened) formerly occurred but are no longer found in the channel area; none of these are likely to be restored to Study Area.
Only one native turtle occurred in the River, the southwestern pond turtle (*Actinemys marmorata pallida*); it is now extirpated from the River basin and is not likely to be restored to the Study Area. Of the 7 lizards of the original native fauna, 6 are considered to still be present in the channel area. These six are: southern California legless lizard (*Anniella stebbinsi*), coastal whiptail (*Aspidoscelis tigris stejnegeri*), Skilton’s skink (*Plestiodon skiltonianus skiltonianus*), western side-blotched lizard (*Uta stansburiana elegans*), San Diego alligator lizard (*Elgaria multicarinata webbii*), and western fence lizard (*Scleropus occidentalis*). The coast horned lizard (*Phrynosoma coronatum*) is likely extirpated from the channel area and is not likely to be restored to the Study Area. Of the 13 snakes in the original native fauna, six snakes are considered to persist in the channel area. These six are: two-striped garter snake (*Thamnophis hammondii*), ringneck snake (*Diadophis punctatus*), southern Pacific rattlesnake (*Crotalus oreganus helleri*), California kingsnake (*Lampropeltis californiae*), California striped racer (*Coluber lateralis lateralis*), and San Diego gopher snake (*Pituophis catenifer annectens*) (Bezy et al. 1993).

California toad, Baja California treefrog, bullfrog, and two striped garter snake are the only reptiles and amphibians currently expected within the aquatic zone of the River in the Study Area (Bezy et al. 1993). The following are the only reptiles and amphibians currently expected in the riparian zone of the River in the Study Area: Pacific slender salamander, California legless lizard, coastal whiptail, San Diego alligator lizard, western fence lizard, western side-blotched lizard, southern Pacific rattlesnake, ringneck snake, California kingsnake, San Diego gopher snake, and south coast gartersnake (*Thamnophis sirtalis*) (Bezy et al 1993). These aquatic and riparian zone species of the Study Area would likely benefit from the proposed Project restoration measures, based on current occupation of the River degraded channel ecosystem combined with general increases in carrying capacity for these species expected from the Project. Crayfish (*Procambarus* sp.) and mosquito fish, both exotic species reported from the River, are noted to feed on the larvae of some native amphibians in the River and are thought to contribute to their local decline (The River Project 2001).

**Birds**

The loss of lowland riparian and riverine ecosystems in coastal southern California has been severe, with a large percentage of dependent natural communities either destroyed or greatly modified over the past century (Garrett 1993). From an avian ecology perspective, even apparently intact riparian and riverine systems typically suffer from the effects of exotic plants, introduced predators, and/or parasitism from artificially high populations of brown-headed cowbirds (Garrett 1993). Comparisons of lowland riparian and riverine bird populations in the River system with those of more natural riparian reaches in other drainages in the region suggest a substantial overall reduction in native breeding species diversity and numbers, and demonstrate a considerable loss of sensitive breeding species in the River (Garrett 1993).

Channelization of the River and its major lowland tributaries was particularly devastating to four natural community types: coastal estuaries, seasonal and permanent freshwater and brackish wetlands, lowland riparian forests and woodlands, and alluvial scrub (Garrett 1993). A number of bird species associated with these communities have either completely disappeared from the Los Angeles River Basin or have suffered considerable population declines. Channelization also
eliminated nearly all the earthen stream bank communities, formerly favored for nesting by such declining species such as the bank swallow. The avifauna of the River drainage has been supplemented with a number of exotic species. All of these exotic species reach peak abundances in urban and suburban habitats, and only a few (e.g., European starling \([\textit{Sturnus vulgaris}]\)) maintain significant populations in native riparian or riverine communities of the River.

Natural community modifications and livestock and agricultural practices in California have allowed for major expansion in range and population sizes of the brown-headed cowbird, an avian brood parasite (Garrett 1993). These inflated cowbird populations have very likely adversely affected several open-nesting passerine bird species in the River drainage over the last century, including willow flycatchers, vireos \((\textit{Vireo sp.})\), gnatcatchers \((\textit{Polioptila sp.})\), and warblers \((\textit{e.g., Vermiform sp., Oreothlypis sp. sp., Setophaga sp.})\) (Garrett 1993). Apart from modifications and loss of habitats, the increase in brown-headed cowbirds may have been the greatest factor in the decline of other native passerines in the River basin; the cowbirds increase is, in turn, related to habitat modification (Garrett 1933). The establishment of feral populations of predatory mammals, such as domestic cats \((\textit{Felis silvestris} [=\textit{F. catus}])\) and red foxes \((\textit{Vulpes vulpes})\), has reduced ground-nesting throughout much of the lowland and suburban portions of the River drainage (Garrett 1993).

The following were likely breeding species in the Study Area historically that are now extirpated as breeders from the River drainage (Garrett 1993): yellow-billed cuckoo \((\textit{Coccyzus americanus})\), long-eared owl \((\textit{Asio otus})\), willow flycatcher, tree swallow \((\textit{Tachycineta bicolor})\), bank swallow, and Wilson’s warbler \((\textit{Cardellina pusilla})\). Tree swallow could likely be re-established to the Study Area with restoration of nest cavities (such as placed snags and appropriate nest boxes); the other noted species are not expected to be restorable to the Study Area.

The following were likely breeding species in the Study Area historically before substantial modifications to the River, but are now greatly reduced in numbers or extirpated as breeders in the River drainage (Garrett 1993): common gallinule \((\textit{Gallinula galeata})\), burrowing owl \((\textit{Athene cunicularia})\), hairy woodpecker \((\textit{Picoides villosus})\), purple martin \((\textit{Progne subis})\), Swainson’s thrush \((\textit{Catharus ustulatus})\), loggerhead shrike \((\textit{Lanius ludovicianus})\), yellow-breasted chat \((\textit{Icteria virens}; \text{“chat”})\), and blue grosbeak \((\textit{Passerina caerulea})\). Swainson’s thrush, chat, and blue grosbeak could likely be re-established in the Study Area with considerable restoration measures, such as any restoration of substantial areas of dense closed-canopy riparian forests, open-canopy riparian thickets adjacent to forest areas, and riparian scrub with low tangled vines/woody shrubs, combined with cowbird control. The other noted species are not expected to be practicably restorable to the Study Area.
A total of 102 native bird species were recorded from the Study Area in 1991/1992 (Garrett 1993). Several native riparian and wetland bird species have been able to maintain current populations in the soft-bottomed channelized portions of the River in the Study Area in the last few decades. These include pied-billed grebe (*Podilymbus podiceps*), cinnamon teal (*Anas cyanoptera*), American coot (*Fulica Americana*), killdeer (*Charadrius vociferous*), black phoebe (*Sayornis nigricans*), northern rough-winged swallow (*Stelgidopteryx serripennis*), common yellowthroat (*Geothlypis trichas*), song sparrow (*Melospiza melodia*), and red-winged blackbird (*Agelaius phoeniceus*) (Garrett 1993). Many other wetland birds are relatively common non-breeding visitors to the Study Area, including great-blue heron (*Ardea herodias*), green heron (*Butorides virescens*), black-crowned night heron (*Nycticorax nycticorax*), great egret (*Ardea alba*), bufflehead (*Bucephala albeola*), spotted sandpiper (*Actitis macularius*), least sandpiper (*Calidris minutilla*), Wilson’s snipe (*Gallinago delicata*), and marsh wren (*Cistothorus palustris*) (Garrett 1993). Almost all of these species would likely increase in number and possibly distribution within the Study Area with implementation of the proposed Project. This would most likely occur associated with any restoration of open shallow water areas, larger open stream areas surrounded by dense riparian cover with minimal human disturbance, large forked canopy trees near water, stream edges with thick vegetation at the margins, and freshwater marsh areas with dense cattails, reeds and/or bulrushes.

An additional select group of relatively uncommon to somewhat common native birds could be substantially re-established or increased in the Study Area with directed restoration or artificial enhancement measures, based on recorded past or currently limited use of the Study Area and environs. These include (Garrett 1993): wood duck (*Aix sponsa*), common merganser (*Mergus merganser*), osprey (*Pandion haliaetus*), sharp-shinned hawk (*Accipiter striatus*), Cooper’s hawk (*Accipiter cooperii*), red-shouldered hawk (*Buteo lineatus*), peregrine falcon (*Falco peregrinus*), barn owl (*Tyto alba*), great-horned owl (*Bubo virginianus*), chimney swift (*Chaetura pelagica*), Vaux’s swift (*Chaetura vauxi*), white-throated swift (*Aeronautes saxatalis*), belted kingfisher (*Ceryle alcyon*), cliff swallow (*Hirundo pyrrhonota*), barn swallow (*Hirundo rustica*), Bewick’s wren (*Thryomanes bewickii*), ruby-crowned kinglet (*Regulus calendula*), western bluebird (*Sialia mexicana*), vireo, orange-crowned warbler (*Vermivora celata*), Nashville warbler (*Vermivora ruficapilla*), yellow warbler (*Setophaga petechia*), Lincoln’s sparrow (*Melospiza lincolni*), lesser goldfinch (*Carduelis psaltria*), and American goldfinch (*Carduelis tristis*). Potential effective restoration and control measures would overlap for many of these species, such as any development of extensive acreages of dense multi-story riparian scrub, woodland, and forest; restoration of wooded stream areas, larger native nest trees, and open woodlands; expansion of mud flats; and cowbird control. Artificial enhancement measures would have less overlap between species, but could practicably be developed in otherwise heavily constrained channel areas, including provision and maintenance of a wide variety of nest cavities (including

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11 Comprehensive bird surveys of the Study Area have apparently not been performed since 1992. A large percentage of the noted 102 species were rarely reported in the surveys of 1991/1992, and were represented by only a few individuals. For these species the River currently represents marginal or poor habitat, or the species are uncommon migrants or vagrants in the region (Garrett 1993).
nest boxes), platforms, and placed large hollow snags; and creation and maintenance of artificial sandy cut banks with openings

**Mammals**
The Los Angeles River basin historically consisted of a variety of natural community types which supported a diverse mammal fauna. Today, coastal sage scrub, alluvial scrub, riparian, and chaparral communities can still be found along the River’s tributaries, but are fragmented and in poor or altered (disturbed) conditions. In these fragmented areas, mammal species composition is fairly consistent with similar communities outside the basin. The mammal fauna that now exists in the channelized portion of the River, such as the Study Area, has changed considerably. The lowland portions of the River have little remaining habitats suitable for native mammal species (Barkley 1993).

Changes compared to the historic diversity and numbers on the River (including the Study Area) are most evident in the paucity of native carnivores (e.g., foxes, weasels, bear, mountain lion); large predators and those requiring relatively pristine or undisturbed habitats (e.g., weasels, grey fox) are particularly reduced (Barkley 1993). The California grizzly and pronghorn that historically utilized the River are now respectively extinct and extirpated, and it is quite unlikely that mountain lion, badger, or long tailed weasels still maintain ranges in the lower River drainage including the Study Area (Barkley 1993). Grassland dwellers (e.g., voles, gophers, moles, shrews) also have apparently declined substantially along the River. Southern grasshopper mouse (*Onychomys torridus ramona*) and California vole (*Microtus californicus*), known from the River drainage previously, are probably rare or nonexistent in most of the basin today (Barkley 1993).

Major resources for all mammal species presently living in or visiting the River basin are water and cover; cover is generally sparse or unavailable in the Study Area (Barkley 1993). Corridors or linkages for many of the original native mammal fauna are also currently not functional to or through the Study Area. The open water occurring in the Project area is a major resource for all mammals, as all mammal species that potentially occur in the area need free water to drink (Barkley 1993). Those areas that also have native vegetation nearby are especially attractive to mammals as this provides cover and possible feeding grounds. Fully channelized portions of the River (concrete bottom and slopes) offer little or no cover (thus little food and high susceptibility to predation) and reportedly are inhabited mainly by exotic rats (*Rattus* sp.), house mice (*Mus musculus*) feral cats, and dogs (*Canis familiaris*). Feral dogs and cats often prey on small rodents and these feral populations are reportedly significant enough in some portions of the River that even where habitats appear suitable such animals likely inhibit native rodent recolonization (Barkley 1993).

Six bat species have detected along the Los Angeles River - Yuma myotis (*Myotis yumanensis*), Mexican freetailed bat (*Tadarida brasiliensis*), hoary bat (*Lasiurus cinereus*), western red bat (*Lasiurus blossevillii*), big brown bat (*Eptesicus fuscus*), western pipistrelle (*Pipistrellus hesperus*) (Barkley 1993; Remington and Cooper 2009). Yuma myotis and Mexican freetailed bat are the two most commonly-observed species in urban southern California (Remington and Cooper 2009). Both are often detected near water sources, where the Yuma myotis specializes in
the capture of emergent aquatic insects, and Mexican free-tailed bat forages opportunistically (Remington and Cooper 2009). The Los Angeles River is likely a feature that funnels activity of both species. Riparian growth in the River and local streams attracts insects and provides the best source of food for insectivorous bats which typically forage above riparian tree tops (Barkely 1993). The major factor affecting influencing bat occurrence and abundance in the Study Area is likely roost availability (Barkley 1993).

The western red bat is a California Species of Special Concern. The hoary bat is a migratory species in southern California that relies on woodland and riparian natural communities, similar to those of the western red bat (Barbour and Davis 1969). Both the hoary bat and western red bat are foliage-roosting species and tend to move the location of their day roost daily from tree to tree; therefore a range of tree options is important for this group of bats (Remington and Cooper 2009). The distribution of Yuma myotis is highly correlated with the presence of permanent water sources such as the River. Yuma myotis, western red bat, big brown bat, and Mexican free-tailed bat appear to be currently roosting within Griffith Park or nearby (Remington and Cooper 2009).

Raccoons (*Procyon lotor*) and coyotes (*Canis latrans*) likely make steady use of the Study Area. Other native mammals that rely on riparian or riverine growth are likely not currently present or are rare in the Study Area. Major restoration efforts in the Study Area would be needed to in order encourage species such as bobcat (*Lynx rufus Californicus*), long-tailed weasel (*Mustela frenata*), Merriam’s chipmunk (*Eutamias merriami merriami*), desert woodrat (*Neotoma lepida intermedia*), and mastiff bat (*Eumops perotis Californicus*) to recolonize and reside in the River portion of Study Area (Remington and Cooper 2009). Nevertheless, we consider the bobcat to be good umbrella planning species for evaluating potential vertebrate movement and corridors through the the Study Area.

Vertebrate Use of Aquatic and Riparian Zones

Riparian and riverine zones of southern California (such as the Study Area historically) are typically resource-rich ecosystems within water-limited, larger landscapes (Stella et al. 2013). Riparian ecosystems normally serve as movement and dispersal corridors for wildlife, particularly for larger vertebrates. Higher riparian plant richness, diversity, and structure provide important resources used by most larger vertebrates, notably resting sites, cover, and food. Additionally, riverine and riparian areas normally have higher water availability, allowing many species to withstand water loss and thermal gradients in the high summer temperatures of the region. Riparian ecosystems also generally have diverse and heterogeneous plant communities. Most carnivore species respond to water channel type and standing water availability in all seasons; use of riparian and riverine ecosystems by carnivores is typically linked to water availability that provides for hydration, foraging, and external temperature regulation (Santos et al. 2010).

Umbrella Planning Species for Riparian Areas

Vireo, chat, and yellow warbler are uncommon sensitive birds that currently make some limited use of the riparian zones within the Study Area. All of these species were likely much more common and made extensive use of the former riparian scrub/woodland/forest areas of the Study Area. 

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USFWS Revised Final Fish and Wildlife Coordination Act Report, January 2015

Proposed Los Angeles River Ecosystem Restoration Project
Area historically (Garrett 1993). Birds are generally valuable indicators of ecological integrity (Carignan and Villard 2002). These three species are typically good umbrella planning or surrogate species for southern California riparian restoration projects on the coastal slope, including the Study Area, due to the range of riparian types and classes used by these species.

Least Bell’s Vireo
In response to a substantial decline of the vireo population and widespread loss of its riparian habitat, the vireo was listed as endangered in 1986 (51 FR 16474). Critical habitat was designated in 1994 (59 FR 4845). A draft recovery plan was published in March 1998 (Service 1998); a final plan has not been issued.

Vireos are an obligate riparian species during the breeding season, and prefer diverse early and mid-successional (e.g., woody riparian vegetation about 3 to 15 years old since the last flood denudation event) riparian thickets. Vireos use a number of riparian natural community types, including cottonwood-willow woodlands/forests, and mule fat scrub. Occupied breeding habitats include dense cover within 3 to 6 ft of the ground, where nests are typically placed, and a dense, stratified canopy for foraging. Plant species composition does not appear as important a determinant in nesting site selection as habitat structure. For more information on habitat requirements during breeding and migration, see the draft recovery plan for the species (Service 1998).

The vireo historically occupied willow riparian habitats from Tehama County in northern California, southward to northwestern Baja California, Mexico (Grinnell and Miller 1944, Service 1998). About 99 percent of the vireos currently occur in southern California south of the Tehachapi Mountains (Service 2006). Thus, despite a significant increase in overall population numbers, and a slight shift northward in the species overall distribution, the population remains restricted to the southern portion of its historic range (Service 2006). Abundance of vireos rangewide has been relatively constant in the last decade (Lynn and Kus 2010, Pike et al. 2010, Jorgensen 2010, McDonald et al. in litt. 2011).

From 1977 to 2005 Los Angeles County supported 2 percent or less of the overall rangewide vireo population (Service 2006). The vireo was formerly a regular breeding summer resident on the River “in the willow lowlands, and along streams up to the foothills” (Grinnell 1898). Grinnell and Miller (1944) alluded to the vireo’s decline beginning in the late 1920s as caused by

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12 The surrogate/umbrella species approach is typically used where conservation actions targeted for one or a small group of species should benefit a broader community of target species and are expected to provide an effective framework to guide ecological restoration efforts. Surrogate or umbrella species are often used as proxies for broader sets of species when the number of species of concern is practicably too great to allow each to be considered individually. We expect that these species would be generally representative of a much larger set of target species and provide a reasonable surrogate for the other species in each group. The logistical constraints of available data and resources often necessitate this approach. Our suggested approach would use multiple species as surrogates for community types/classes instead of the typical single species approach. See Seavy et al. 2012.
cowbird brood parasitism. Little successful nesting by vireos has been documented recently in the River drainage, outside of the area behind Hansen Dam and the Sepulveda Basin; cowbirds are reportedly common at all potential nesting sites along the River and their abundance would make successful nesting by vireos unlikely in most areas (Garrett 1993). The vireo was nearly eliminated as a breeding species in the River (Garrett 1993). An undetermined (but likely small) number of vireos was reported in 2009 and 2013 from within the Study Area near Taylor Yard (USACE 2013a).

Additional information on the vireo can be found in the Service’s 5-year review (Service 2006) and draft recovery plan (Service 1998) for the species.

Yellow-Breasted Chat
The chat is a California Species of Special Concern that breeds from British Columbia, Ontario, and (rarely) Massachusetts south to California, the Gulf Coast, and Florida. They winter in the tropics.

Chats are foliage gleaners and consume insects and berries about equally (Ehrlich et al. 1988). Nestlings are typically fed a diet of soft-bodied orthopterans (e.g., grasshoppers) and larval lepidopterans (Petrides 1938).

In California, chats require dense riparian vegetation associated with streams, swampy ground and the borders of small ponds (Small 1994). Some taller trees (i.e., cottonwoods and alders) are required for song perches (Dunn and Garrett 1997). Blackberry (*Rubus* spp.), wild grape (*Vitis* spp.), willow, and other plants that form dense thickets and tangles are frequently selected as nesting strata (Grinnell and Miller 1944). The nest is a bulky cup that is normally a well-hidden structure, commonly placed about 3 ft above ground (Petrides 1938, Dunn and Garrett 1997). Nesting chats occupy riparian habitats with a well-developed shrub layer and an open canopy. Vegetation structure, however, more than age appears to be the important factor in nest-site selection (Eckerle and Thompson 2001). Nesting habitat is usually restricted to the narrow border of streams, creeks, sloughs, and rivers. Garrett and Dunn (1981) described the chat as having “greatly declined as a breeder in recent years” in southern California.

Chats are relatively rare and localized in Los Angeles County (Shufurd and Gardali 2008). Chats were formerly a “common summer resident in the willow regions of the lowlands” (Grinnel 1898) of the River, but are now rare breeding summer residents or scarce transients (Garrett 1993). Two territorial chats were reported from the Study Area near the Taylor Yard in 2010 (Hall 2010).

Yellow Warbler
The yellow warbler is a California Species of Special Concern. Yellow warblers breed across central and northern North America and spend winters in Central America and northern South America. They occur principally in California as a migrant and summer resident from late March through early October, breeding from April to late July (Dunn and Garrett 1997). Grinnell and Miller (1944) formerly described the yellow warbler as a “common” to “locally abundant” breeder throughout California, except for most of the Mojave Desert.
Yellow warblers were nearly extirpated from the coastal lowlands of Orange County by 1990 (Garrett and Dunn 1981, Gallagher 1997, Unitt 2004). Yellow warblers have increased greatly on the coastal slope in San Diego County since the late 1980s, apparently in response to habitat restoration and cowbird trapping to aid vireos (Unitt 2004).

Yellow warblers generally occupy structurally diverse riparian vegetation in close proximity to water along streams and in wet meadows (Lowther et al. 1999; Strusis-Timmer 2009). In California they are found in willows and cottonwoods and other species of riparian shrubs or trees, varying by biogeographic region. Yellow warblers are a shrub nesting species in California, often utilizing early successional patches (Strusis-Timmer 2009). Coastal California yellow warblers often utilize areas with a short, sparse riparian deciduous canopy and extensive willow shrub cover (Strusis-Timmer 2009).

Yellow warblers were formerly common breeders along the River, and were “particularly numerous and well distributed over the mesas and lowlands” along the River (Grinnel 1898). The decline of this species on the River can probably be attributed to loss of riparian habitat and, in part, to cowbird parasitism (Garrett 1993). It is currently a common spring and fall transient throughout the River drainage and an uncommon breeding summer resident in cottonwoods and other riparian habitats of foothill canyons, including along the Arroyo Seco, Santa Anita Canyon, and the Rio Hondo. (Garrett 1993). As of 2005, 6 to 10 pairs of yellow warblers were reported nesting along the River in the Study Area just northwest of downtown Los Angeles (Shufurd and Gardali 2008). Nine territorial yellow warblers and evidence of young were reported from the Study Area near Taylor Yard in 2010 (Hall 2010).

Environmental Heterogeneity
Natural ecosystems have long been thought of as complex systems, wherein the conditions for sustaining biodiversity are optimized (Nicolis and Prigogine 1977; Fath et al. 2004). Generally complex structures and dynamics are distinct attributes of natural ecosystems, which can be empirically tested and measured (Parrott 2010). Complexity has been defined as a balance between the two extremes of order and disorder (Langton 1992; Levin 1992; Parrott 2010). Environmental heterogeneity is the spatial or temporal variation of a given resource, structure, or biota in a given area. The Study Area has low environmental heterogeneity: it is ecologically extensively homogenous and modified compared to its natural state. The pattern of resources, biota, and natural structures in the River ecosystem has been modified over the last century to become rather uniform, and native biodiversity has largely collapsed.

Ecological Connectivity of Channels
An important design component and strategy of conservation planning is the retention or restoration of ecological networks. An ecological network is a nature conservation system where large reserves are connected to each other via ecological linkages or corridors across broad landscapes to facilitate recolonization and persistence of wildlife populations, particularly those threatened with extinction or local extirpation (Jongman, 2004; Noss, O’Connell and Murphey 1997). Some European countries have used rivers as an organizing principle for national ecological networks (Jongman 1998). Hydrologic networks are inherently a hierarchically connected system and logically meet the need for connectivity of many species in nature reserve
systems. However, hydrological networks alone are insufficient to meet the functional connectivity needs of all important organisms (Huber, Shilling, Thorne, and Greco 2012; Jongman 1998). Nonetheless, where river and stream systems can contribute to ecological conservation and connectivity, conventionally designed flood control channels often offer limited or no value because they commonly lack many of the important ecological attributes, such as contiguous vegetated cover, functional ingress/egress routes, or appropriate substrates. It is vitally important to the integrity and viability of river and stream systems that ecological conservation functions be incorporated into the planning and design process of multifunctional open channel flood control structures, to the extent practicable.

EFFECTS OF THE PROPOSED PROJECT ON BIOLOGICAL RESOURCES

Implementation of the proposed Project would likely result in direct and indirect effects to biological resources during demolition, clearing, grading, structure construction, operations, and maintenance. Most of these impacts would likely be temporary and relatively minor to moderate in extent. Proposed restoration measures would likely more than offset these impacts, and would improve riverine and riparian ecological functions of the Project following Project construction activities.

Potential construction-related impacts include increased stream turbidity, clearing of extant riparian or riverine natural communities, noise, night-time lighting, and contaminant introduction or release into stream waters, wetland, or upland areas. Most of these impacts would occur during the relatively short construction period of the Project and would likely be temporary. The resources that would be affected, notably riparian and riverine natural community remnants along the River, are already heavily degraded by past actions (particularly channelization and development) within and along the River channel and former floodplain.

While the proposed Project would provide substantial ecological enhancement and partial restoration to the portions of the highly degraded River, the designs currently proposed would nevertheless still provide largely unnatural biological conditions as compared historic conditions and to other southern California coastal streams in urban areas (Mazor et al. 2011). For example, the proposed Project would likely provide/retain mostly rock and concrete substrates, low natural community/habitat complexity within riverine and riparian systems, relatively high ongoing human disturbance near or in most restoration areas, high levels of open water and exotic species, simple channel geomorphology with many hard structures, high water temperatures, and low levels of riparian vegetation acreage and age/cover/species diversity.

Habits for vireo, chat, and yellow warbler would likely be temporarily disturbed by Project construction and then subsequently restored and expanded, with an undetermined acreage of created riparian habitats, and an associated undetermined level of likely increase in use by these species. Native fish are currently extirpated within the Study Area; some potential exists for re-establishment of habitats for Santa Ana sucker and arroyo chub as part of Project restoration, depending on how riverine and riparian restoration would be designed and performed.
The ecological functions of riverine and riparian areas/fragments normally depend not only on their size and internal features, but also on their configuration relative to one another and the characteristics of the surrounding landscape (Andren 1992 & 1994; Sisk et al. 1997; Saab 1999; Tewksbury et al. 2002). As such, additional projects would need to be implemented outside of the Project area in order to partially restore many important basic riparian and riverine ecosystem functions within the Project footprint. For instance, substantial modifications to the watershed and River upstream would be needed in order to restore natural stream sediment supplies that are key to the River’s natural fluvial processes in the Study Area and areas downstream. Similarly, downstream channel modifications and enhancement would likely be needed to restore effective fish passage and conditions/linkages in order for some native fish to become established and make considerable use of the Project reach proposed to be restored. Nevertheless, substantial restoration potential exists within the Study Area, and the Project would have individual and incremental biological benefits.

Ecological Benefits of the Proposed Project

From an environmental heterogeneity standpoint, the proposed Project would substantially improve portions of the Study Area (particularly Taylor Yard and Piggyback Yard) from a highly modified/uniform ecosystem to semi-natural/disordered ecosystem (Seiferling et al. 2014). The environmental heterogeneity/biodiversity relationships in the currently homogenized ecosystem would be increased, since the Project would add naturalistic heterogeneity and complexity through increases in habitats, channel/floodplain forms, vegetation structures, and resource opportunities, which should promote niche partitioning and some improved native species coexistence.

Within the Study Area the riverine and riparian natural communities are currently greatly reduced, degraded, and isolated remnants of their former extents. Following implementation of any of the Project alternatives, both riverine and riparian natural communities would be enhanced and expanded. Considerable creation of wetlands would occur. Nevertheless, with Project implementation these areas would remain relatively fragmented and isolated; this is to be expected considering the many constraints to restoration of ecological connectivity due to the heavy urban context of the Study Area. Some improvements in ecological connectivity, such as enhanced movement corridors for some small vertebrates, would occur due to Project restoration/enhancement measures, with the level of improvement varying by Project alternative. The Project would provide moderate long-term benefits to the same native biological resources that would be temporarily adversely affected by construction through creation (re-establishment) or enhancement of many stream and riparian natural community features in portions of the Project footprint, particularly through channel widening and re-establishment of some areas of

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13 In a comment letter to us dated May 14, 2014, the Corps commented that proposed Project “[b]enefits may include potential re-introduction of fish (Santa Ana sucker (SAS), arroyo chub), benefits to least Bell’s vireo (LBVI) and other threatened and endangered (T&E) species, contributions to restored connectivity for wildlife movement, and contributions to potential future connectivity to significant regional habitat areas.”
former floodplain and associated riverine and riparian natural communities, such as semi-natural aquatic soft-bottom channel and valley foothill riparian areas. Actual enhancement and partial restoration levels that would likely be attained by the Project are difficult to ascertain, due to the general or vague descriptions in the 2013 EIS/EIR, such as “Approximately 60 acres of riparian habitat corridors would be restored along the overbanks of both sides of the river. Overbanks are those areas adjacent to the river where overland flow in flood events could occur in a natural river environment” (Section 7.1.1).

The Project as proposed would provide ecological enhancement and partial riverine and riparian restoration to a highly degraded stretch of the River. The Project would likely provide modest ecological net gains, particularly for native species that are somewhat tolerant of urban or degraded environments, such as certain migratory and resident birds that currently utilize riverine and riparian natural communities (as noted above). Increased function and occupation by native small mammals, reptiles, and amphibians would likely be low to moderate. Pursuant to the objective of restoring biological diversity to the Study Area, we do not expect re-establishment of any extirpated reptiles, amphibians, or large mammals with implementation of the proposed Project. Increased or restored function and occupation by large mammals would likely be quite low, outside of coyotes.

The Project would provide considerable riparian corridor management; this one of five key high priority action items identified for the River for re-establishment of Southern California Steelhead DPS (NOAA 2009). The proposed Project would provide general ecological improvement of aquatic natural communities in the Study Area. The Project objectives include “Restore…native fish habitats…throughout the Project period of analysis…” On the other hand, the 2013 Draft EIS/EIR does not specify which of the seven potential native fish species formerly found in the River would be the subject of the restoration objectives of Project, nor did the document provide basic design parameters or concepts that would lead us expect restoration of functional habitats for native fish. In our opinion, the current Project description and designs do not appear sufficient to provide restoration that would support any of the native fish outside of the short-term. For example, the proposed Project design drawings show substantial areas of unnatural open water (unshaded, relatively still areas of surface water mostly free of emergent vegetation, etc.) that, if implemented, would likely give substantial competitive advantage to the exotic fish and invertebrates in the Study Area over potential native fish such as Santa Ana sucker or arroyo chub. With modifications to the proposed Project designs and implementation, the Study Area could likely support some native fish, as noted in our Recommendations below.

The carrying capacities of the Study Area would likely be improved and enhanced for a few sensitive species, such as vireo; it is difficult to estimate the acreage or numbers of pairs of vireo that would likely be restored and enhanced by the Project, based on the relatively vague information provided. Native riparian and riverine plant diversity and function would substantially increase, but remain relatively low compared to some reaches of similar rivers, such as the Santa Ana River or San Luis Rey River, in an urban context. The Proposed Project would
provide considerable areas of native landscaping\textsuperscript{14} along the River, with some benefits to connectivity and function along the River, mostly for non-sensitive native birds. Overall numbers of native wildlife, particularly birds, is expected to substantially increase. Local opportunities for observing native birds and invertebrates, aquatic and riparian natural communities, and native plants would be drastically improved.

Alternative 13 would provide approximately 588 ac of partial general restoration, including (with undefined proportions of) valley foothill riparian, freshwater marsh, and open water natural communities, and other wetland areas. Alternative 20 would boost this same basic acreage, and provide an overall total about 719 ac of partial restoration, with undefined portions of those same natural community types.

Additional information on potential Project effects is described in the 2013 Draft EIS/EIR.

**CUMULATIVE EFFECTS**

Compared to the subject proposed Project, a smaller scale recreation and “greening” open space project on the River is proposed approximately 6 mi upstream, along a reach of the River between Coldwater Canyon Ave. and Whitsett Ave. This proposed project is named the “Los Angeles River Greenway Trail, Coldwater Canyon Ave to Whitsett Ave, San Fernando Valley.” This project would create an access trail and native landscaping along about a 0.5 mi stretch of the existing River concrete flood channel (Community Conservation Solutions 2014). While stating that it would “Restore a native ecosystem of oak woodland, chaparral and mixed scrub,” this project would only provide minor ecological enhancement on an existing strip of exotic landscaping in this same area along the flood channel; the River itself would remain a concrete flood channel facility.

A proposed project named The Los Angeles River Natural Park is envisioned as a “Green Solution” river-oriented park on a 16-ac project site in Studio City, also about 6 mi upstream of the subject proposed Project. The proposed L.A. River Natural Park would create a wetlands complex to capture and improve runoff water quality from a 200-ac surrounding area, and provide human access to the L.A. River Trail. The Park would create a public access hub for pedestrians and bicyclists and include a public parking garage, pedestrian bridges, and improvements to the L.A. River Trail (Community Conservation Solutions 2013).

Please see the 2013 Draft EIS/EIR for additional cumulative effects information regarding biological resources in the Study Area.

\textsuperscript{14} Landscaping: using living, natural, and human elements in the art and craft of growing plants with a goal of creating a beautiful and naturalistic environment within the landscape.
RECOMMENDATIONS

The FWCA states that “…wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs through the effectual and harmonious planning, development, maintenance, and coordination of wildlife conservation.” With the following recommendations we are suggesting “…measures that should be adopted to prevent the loss of or damage to …wildlife resources, as well as to provide concurrently for the development and improvement of such resources.”

Available funding for fish and wildlife conservation is sparse and usually competitive, normally limiting related actions. Expending conservation resources in areas of high human density is quite costly and often considered less likely to succeed. Yet, coastal southern California contains a large fraction of endemic at-risk species and (now) rare ecosystems, as well as the state's three largest metropolitan regions. As such, understanding the context and capacity to enhance, restore, conserve, and access ecosystems and native fish and wildlife species within this highly urbanized coastal region is a conservation/societal priority. The values of partially restoring and enhancing the ecosystems of the River are greater than the potential biological conservation benefits alone.

As outlined below, we generally suggest that the designs for proposed Project be developed with a stronger focus on principles of restoration of stream natural communities and processes. We understand that the Study Area is within a heavily populated urban area, and we acknowledge that the varied constraints to ecological restoration of the River are tremendous; we are also well aware that the Project design selected can not increase flood risks.

Based on our Project discussions, the Corps appears to define partial ecological restoration as improvements in habitats or ecological functions. As we have noted above, we expect that full or partial restoration also includes a self-sustaining component as essential to the definition of restoration, even in highly constrained project areas. This is more than semantics, due to the considerable number of restoration projects continuing to be developed and reviewed by our agencies; it is important that we understand each of our respective definitions. While ecological improvements and benefits such as artificial enhancements are highly important and valuable in many areas, we continue to stress the essential long-term importance of at least partial recovery of self-sustaining ecological functions for restoration projects. For example, this would mean evaluating whether proposed native vegetation in some plating areas would not only survive in the long-term without permanent irrigation, but would it also effectively reproduce and replace itself (or naturally succeed) both over time and following expected disturbances such as periodic flooding events.

In part, the current proposed Project designs (all alternatives) appear substantially compromised by proposed recreational, and aesthetic features, often at the expense of otherwise practicable ecological restoration potential (e.g., restoration of relatively natural complexities of processes, substrates, channel/floodplain forms, and natural communities/habitats in some areas). The current designs in many locations are also heavily compromised by the lack of channel widening; this is understandable given the consistent need to maintain channel flood flow capacity and the
surrounding constraints. It is understood that widening the channel and floodplain cannot be practicably accomplished throughout the whole Study Area with the subject Project. The resultant potential for partial restoration of ecological functions in these areas of unwidened channel is quite low. Our specific recommendations below reflect these combined issues.

1. We promote the restoration and enhancement of fully functioning and self-sustaining ecosystems, where and to the extent practicable. As we have noted otherwise herein, the River is not restorable to a self-sustaining, full function stream system, even within the proposed widened floodplain areas of the Project, due to the constraints of the Study Area and watershed (e.g., reduced fluvial sediment supply from upstream, modified hydrograph, water quality and temperature, etc.). On the other hand, substantial enhancement and partial restoration of the River is practicable in respective portions of the Study Area. The proposed Project has good basic goals and objectives in relation to general fish and wildlife resources, though they (combined with the Project description and figures) are currently too vague for us to assess the fundamental ecological functions and values of restoration and enhancement that would be implemented. Pursuant to the current Project goals and objectives (to the extent practicable), we suggest the Project designs be modified to more clearly focus on restoration of substantially more natural function of riverine and riparian natural communities in the Project. The proposed channel/streamside ecological structures and natural communities within the River reaches to be partially restored/widened (e.g., former rail yards) should be designed to be more like similarly situated southern California River reference sites (e.g., less open/slow moving water areas), including designing in greater channel/aquatic and riparian area complexity and utilizing natural community compositions and substrates that support higher sensitive taxa richness. The current proposed designs and descriptions for restoration areas read more like landscaping plans than restoration plans. The objectives, designs, and Project description should indicate enough specificity to allow evaluation of the rough elemental ecological gains that would be made (for example, specify the individual minimum acreage of valley foothill riparian strand, freshwater marsh, etc., that would be created or enhanced in each reach, instead of consistently lumping this information); these data are currently lacking. We commend the integrated multi-project, step-wise approach planned for partial restoration and enhancement of the River that would be hopefully continued with future projects.

2. Of the Project alternatives currently proposed, we recommend Alternative 20, with modifications (as noted below). Alternative 20 has the highest potential of the proposed alternatives to restore considerable ecological functions of the River. In order to perform any substantial riverine and riparian restoration or enhancement on the River (and maintain current flood flow capacities for flood risk management), the right-of-way (ROW) and floodplain currently utilized by the River will need to be re-widened in considerable River reaches (as noted in the 2013 EIS/EIR). This is because effective restoration cannot be performed within the confines of the existing channelized River without reducing flood carrying capacity of that same channelized reach (e.g., due to channel “roughness” associated with mature woody vegetation) unless a wider/larger area
to carry the same flood flows is provided. As such, truly effective ecological restoration of the River (partial restoration) can only occur in areas of widened River ROW.

We recommend substantive modification of any approved Project alternative to increase the focus of proposed Project resources on practicable levels of restoration of River hydrology and geomorphology. We expect that the current proposed designs (all proposed alternatives), if implemented, would result in improvements, but relatively small native fish and wildlife resource net gains and overall low ecological integrity and function for these species within Project restoration and enhancement areas, due to very important remaining stressors such as: a) resultant low complexities of substrates/geomorphology/hydrology/natural communities; b) large areas of artificial (slow moving low flow) open water and channel; c) high human disturbance near stream banks; d) low cover levels, structure, and diversity (e.g., age classes) of native riparian and riverine vegetation; and e) substantial use of proposed hard structures. These stressors can be reduced with potential Project designs, such as maintenance of relatively natural lotic (flowing water; we suggest less area of still, open water) conditions over the length of the Study Area, but some of these stressors would remain with all practicable designs. Considering the constraints involved, we nevertheless suggest that it is practicable for the designs for Project restoration areas (areas of widened floodplain) to be more “wild” and less “naturalistic”\footnote{Naturalistic: looking similar to what appears in nature; not looking artificial or man-made. Not necessarily retaining the functional characteristics of natural ecosystems, such as self-sustainability, functional food webs/native species interactions, etc.} ordered (such as by hard structures and slope protection) than as shown within Project concept drawings and designs.\footnote{In email attachment to us dated 25 November 2014, the Corp noted: “The Corps’ intent is that the stressors described will be addressed in widened areas, where increased flood capacity will allow for varied substrates and natural hydrology, high vegetative cover and structural diversity, and very limited and well-buried hard structures. Open water areas will be designed to support native fish such as Santa Ana sucker and Arroyo chub, including riffle/pool/glide sequences. Human disturbance is expected to be minimal in widened areas, where recreational dirt trails will be designated. In widened areas, it is expected that the active channel will migrate and change form and that sediments will be redistributed with storm events. Vegetation is expected to be denuded with natural higher flows and velocities, and be re-established naturally. Any grade stabilizers in these areas will be well buried, and not visible from the surface.”}

We suggest that riverine and riparian ecological (partial) restoration be more clearly the primary goal within the specific River reaches to be widened. For instance, most widened floodplain areas should be designed for riparian scrub-woodland-forest communities relatively similar to those that existed historically in the Project reaches, including providing for cyclical and episodic succession of riparian natural community age classes over time following denudation events (floods). Proposed Project designs should rely on utilization of existing groundwater (e.g., less than 6 to 8 ft from the ground surface for riparian natural communities) and natural surface water flows for native vegetation needs (e.g., see Stromberg et al. 1996; Stromberg 1998). Restoration of
widened floodplain areas should also be designed with the expectation of some channel form changes over time: large flood events should be allowed to provide some channel re-setting (geomorphic change) action within the necessary outside flood risk management sideboards of widened River reaches.

3. Project recreation/access features involving hard structures should be limited to the outside periphery of widened/restored River stretches (such as Taylor Yard and Piggyback Yard). Many of the design drawings show substantial “hard-scaped” recreational features well within widened-reach restoration areas. Limiting recreational structures within the interior of restoration areas would both reduce potential for flood damage/maintenance of expensive structures, and would likely increase the biological function in these widened reaches for native species. The proposed construction of instream and floodplain hard structures that are out of context with naturally functioning systems (e.g., retaining walls, curbs, formal paved or heavily compacted or surfaced paths, boardwalks, grade control structures, etc.) should be minimized within restored areas in widened reaches (Kauffman et al. 1993). Also, such hard structures typically reduce the actual and perceived “wild” nature of areas, reducing the effective nature experience for people (Louv 2012, Cookson 2013).17 We recognize that recreation enhancement projects within the River should inspire new River “stewards,” who would be fundamental in the protection of these natural systems in the future. As such, we suggest designing “organic” recreation enhancement features that instill “adventure” and “challenge,” in part through subtle engineering solutions that accommodate River recreation without degrading development of natural River ecosystem features and functions (e.g., see Borgman 1995). Pursuant to our Connecting People with Nature policies, we suggest that Project designs be modified with a greater emphasis on restoration of (and access to) the “wildness” of the River within these widened reaches, to the fullest extent practicable. Compared to current designs, such restoration would likely result in higher abundance of native fish and wildlife and greater levels of native biodiversity, with resultant enhanced opportunities for uncommon wildlife observation and nature experiences.18

4. Similar to our suggestions regarding Project recreation structures above, we suggest that the potential ecological interactions between the riparian and aquatic ecosystems be

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17 In email attachment to us dated 25 November 2014, the Corp noted: “As required, the Recreation Plan was developed after restoration features were planned. Recreation features include passive activities such as hiking, walking, and wildlife viewing. Widened areas supporting restoration of more natural hydrology such as Taylor Yard and LATC (a.k.a. Piggyback Yard) will support a limited length of dirt/gravel trails that will not impede hydrologic and ecologic functioning. Recreation structures such as restrooms and parking lots will be limited to the outside edges of widened areas and along overbank recreation trails. New trails throughout the project area will be unpaved, and certain currently paved access roads will be converted to dirt/gravel.”

reflected more fully in the Project restoration and flood damage reduction features proposed. We suggest minimization of instream flow-control hard structures and unburied hard streambank slope protection in widened reaches, particularly along the riverine-riparian interface. These features often result in severed linkages between aquatic and riparian ecosystems (Kauffman et al. 1997). Any new essential instream and riparian hard-structure features (e.g., flow control and retaining walls, culverts, etc.) should be naturally complex (e.g., buried rock instead of surface concrete where practicable), accelerate riparian recovery, and imitate natural processes and functions (Kauffman et al. 1997). While acknowledging the context of the Study Area, the hydrology designs for widened River reaches to be restored (such as Taylor Yard and Piggyback Yard) should accommodate, to the maximum extent practicable, the dynamic and episodic nature of surface low and high River flows and the fluvial processes that were natural to the River, including water inlet and outlet structures that provide for a relatively natural high-flow hydrograph to newly created riparian areas. Restoration designs for low-flow channel paths and water inlet/outlet structures for widened reaches should emulate the full range of natural flow events and groundwater levels that original riverine and riparian terrace natural communities were subjected to before development. Restoration designs should reflect and emulate the fact that the natural River channel and riparian zones were (historically) dynamic both spatially and temporally, and that episodic denudation flood flows are natural and necessary to riparian integrity (e.g., cycling of seral stages) in the Study Area.

While we understand the major design constraints of the Project area, we suggest that the current proposed Project designs (even though an improvement over existing conditions) would retain many of the existing rather simplified (“naturalistic”) features of the River in widened/restored areas. These reaches of low natural heterogeneity, as designed, would have continuing negative influences on local channel hydrodynamics, channel morphology, and native streambank surface cover and function for native species. As such, these features would likely have long-term detrimental influences on important riparian/aquatic interactions by reducing shade over water, stream nutrient inputs, and woody debris inputs, and ecosystem productivity would not meet its full potential.

The riverine and riparian ecosystems that are expected to be at least partially restored by the proposed Project are episodic disturbance oriented/dependent ecosystems. As such, in areas where the River would be substantially widened, we suggest that Project designs should not intend to fully “lock” the low-flow channel in one place, but instead should allow for some limited amount of channel migration over time between the “sideboards” otherwise necessary for flood damage reduction capacities (in the heavily constrained context of the Project area). Almost all restored floodplain terrace ground surfaces should be well within the distances to groundwater that can be utilized naturally by the expected native riparian vegetation and designed for appropriate episodic succession-setting flooding events necessary to sustain the target natural communities (e.g., willow-
cottonwood woodland) and habitats (e.g., vireo habitat) in the long-term, with no reliance on periodic replanting for replacement recruitment.\textsuperscript{19}

5. Within the Project portions of the River that would not be widened by the proposed Project, we suggest that ecological enhancement, native landscaping, recreation, buffer, and/or stream water shading be the stated goals for and focus of Project activities in most of these areas. While providing some ecological improvement, we suggest that these features be treated as ecological enhancement because the substantial constraints in these reaches preclude self-sustaining full or partial restoration of most of the important riverine or riparian ecological functions of the River. Expectations of substantial occupation or connectivity use by typical target native species in portions of the River that would not be widened should be low, with the exceptions of any implementation of specific artificial enhancements (such as developed artificial snags, nesting cavities and shelves, and riverine hardscape pools and riffles). Establishment of native trees on the south side of the River where water shading can be accomplished would enhance stream water temperature reductions that may help provide for limited use of other Project areas by native fish. We find this distinction between restoration and enhancement to be important due to the precedent this could set for ecological restoration within other projects.\textsuperscript{20}

6. We suggest that the Project ecological guidelines and designs for restoration be based on typical restoration ecology\textsuperscript{21} science and terminology, and less on landscape

\textsuperscript{19}In email attachment to us dated 25 November 2014, the Corp noted: “…the Corps’ intent is that that widened areas will support high levels of heterogeneity. The active channel will migrate and change form and terraces and sediments will be redistributed with storm events. Initial grading during construction of widened areas will be heterogeneous and diverse topography will be created. The dynamic and episodic nature of the River flows will be accommodated in these areas, allowing the River to carve new channel configurations over time. Vegetation is expected to be denuded with natural higher flows and velocities, and be re-established naturally. Any grade stabilizers in these areas will be well buried perpendicular to flows, and not visible from the surface. Once initially planted and a seed bank established, passive recovery will be the method for re-vegetation after flood events. Such natural hydrologic functions would support riparian/aquatic interactions by providing habitat elements including shade over water, and stream nutrient and woody debris inputs.”

\textsuperscript{20}In email attachment to us dated 25 November 2014, the Corp noted: “The Corps disagrees that individual project features should be parsed out as “restoration” vs. “landscaping” vs. “greening”. While the definition of “restoration” as provided by USFWS is not achievable in every portion of the project area, the project as a whole meets the Corps’ criteria for ecosystem restoration, in that all features collectively contribute to habitat and connectivity creation and improvement throughout the project area. In this way, wildlife is provided new large areas (e.g. 35+ acre sites such as Verdugo Wash, Taylor Yard, and LATC (a.k.a. Piggyback Yard)) of restored habitat with a means to move between them, as well as into other surrounding natural areas.”

\textsuperscript{21}Restoration ecology: the scientific study of repairing disturbed ecosystems through human intervention. Ecological restoration implementation aims to recreate, initiate, or accelerate the recovery of an ecosystem that has been disturbed.
architecture\textsuperscript{22} science and terminology. Baseline and post-Project implementation surveys/assessments for fish, amphibians, reptiles, and the associated parameters of potential habitats for target species should be performed in the Study Area. Non-native species with considerable potential to adversely affect Project restoration success should also be assessed, including potential source populations in the watershed.

The following water quality parameters of specific Project reaches should be evaluated and mapped as part of Project planning and implementation: water temperature, dissolved oxygen, pH, conductivity, turbidity, substrates, water velocities, channel forms (e.g., deep or exotic predator-free pools), flood refugia and back-channel areas, woody debris and leaf litter. These parameters and natural community mapping should be analyzed relative to current non-native fish, amphibian, and reptile occupation of the Study Area. These parameters should then be compared to known ideal (and minimum) necessary natural parameters and conditions of habitats normally utilized by species such as Santa Ana sucker, arroyo chub, two-striped garter snake, California toad, Baja California treefrog, and other appropriate restoration indicator and surrogate/umbrella species. This survey information should be used to inform basic Project design development (e.g., to provide functional habitats for specific native fish and aquatic wildlife species), as well as post-construction adaptive management decisions, and future restoration projects in the watershed.\textsuperscript{23}

7. In relation to the needs of any of the seven native fish that could potentially be re-established in the River (such as arroyo chub), the proposed Project as currently designed would appear to: a) lack necessary complexity of habitats; b) lack necessary substrates and channel forms, including refugia; c) provide low food availability; d) be subject to excessive water temperatures; e) have an overabundance of large areas of open water; and f) provide/retain competitive advantage for exotic fish species over native species. The Project ecological restoration designs should provide higher priority to creating the natural parameters and conditions needed for the restoration of at least one specific native

\textsuperscript{22} Landscape architecture: the art and practice of designing the outdoor environment, especially designing parks or gardens together with buildings and roads.

\textsuperscript{23} In email attachment to us dated 25 November 2014, the Corp commented: “The Monitoring and Adaptive Management Plan (MAMP) to be included in the Final IFR document includes pre- and post-restoration monitoring to evaluate the performance of restoration actions. Habitat evaluations will be performed as restoration progresses to assess habitat values of restored features and inform adaptive management decisions. These evaluations require an inventory of wildlife species based on observations of wildlife and signs of usage, mapping of habitat, as well as inventory of habitat elements present within the project footprint. Monitoring of riparian, marsh, and fish habitat is outlined in the MAMP, which evaluates various habitat parameters including, but not limited to, invasive plants, hydrology, soils, sedimentation, water quality, in-stream structure, and also includes bird, fish, and amphibian species surveys. These habitat parameters can be compared to ideal reference conditions to inform adaptive management decisions and direct restoration actions. The MAMP will be revised to include a list of target species in order to direct restoration of habitat elements in ways that would benefit the life history requirements of those species.”
fish species, to the extent practicable, so as to both support their basic survival and to give them competitive advantages over exotic species that would likely continue to occupy the Study Area following Project implementation (e.g., see Moyle and Light 1996). Assessments of whether proposed Project designs would likely provide these specific natural conditions for target species, including expectations of associated non-native species competition, should be provided before Project designs are developed further.  

8. In our opinion, the various alternatives proposed would provide limited restored functions for typical stream restoration target species. Considering the heavy constraints of the Study Area, some excellent opportunities exist for artificial enhancement measures, particularly where restoration is not practicable. Additionally, these types of features (e.g., large hollow snags, tall steep river banks) are not likely to otherwise develop in the short-term or over time in significant number/area within the Study Area due to the limited floodplain widths and modified hydrology in even the widest proposed restoration sites of the Project. The directed artificial measures suggested below would likely be substantially and quickly utilized by some uncommon or sensitive bird and bat species and could provide very attractive and important watchable wildlife opportunities along the River for residents and visitors. These features could be effectively incorporated into many otherwise heavily constrained channel reaches and off-channel adjacent areas that otherwise lack the space to support aquatic or riparian restoration features (such as artificial features added to walls, bridges, and other hard structures). These include: provision of various nest cavities and structures (e.g., for wood duck, barn owl, osprey, tree swallow, white throated swifts, and western bluebird) such as nest holes/crevices created in/on new and existing hard structures, and nest platforms/shelves/boxes; placed/erected large hollow snags and suitable vertical shafts with heavy inside texture (e.g., swifts); and creation of artificial large steep sandy/earth banks (e.g., northern rough-winged swallow and belted kingfisher; note that these supported banks could functionally occur along channel tops in some areas, without affecting flood conveyance). Directed artificial enhancement measures for some local bat species (e.g., Yuma myotis, western pipistrelle, Mexican free-tailed bat, and big brown bat) should include increasing availability of roosts in the Project area by providing large hollow vertical snags and shafts, rock outcrops, bat boxes, and artificial roost cavities designed

24 In email attachment to us dated 25 November 2014, the Corp commented: “The design drawings at the feasibility level are conceptual, and will be revised and refined during the detailed design stage to include the necessary parameters that would support native fish habitat in widened areas and in overbank areas during the detailed design phase. In concrete reaches, where features are more limited by maintenance of flood capacity, designs will focus on providing refugia and passage. As discussed with USFWS, designs will focus on providing the hydrology, substrates, and habitat elements required by Arroyo chub and Santa Ana sucker. In the Draft IFR, in Section 4.2.2, Santa Ana sucker are identified as a target for restoration of native fish habitat. Other target fish species for restoration as well as their general requirements will be clarified in the Final IFR document.”
into new hard structures. Almost all of these artificial features would require some limited periodic maintenance or replacement.

9. Brown-headed cowbird occupation of the Study Area should be assessed during Project planning, including potential source populations in the region within several miles. Cowbird feeding areas (e.g., outdoor human feeding areas, stables and other equestrian facilities, and some turf zones) should be reduced or modified in the Project general region, to the extent practicable. If brown-headed cowbird parasitism levels are still likely to be problematic for sensitive birds potentially occurring within the Project area, then management of cowbird numbers should be performed by the Project for the life of the Project, such as through trapping at local horse stables and other cowbird source or breeding areas, with standard cowbird traps. We recommend a long-term management strategy for cowbirds be developed by the City and Corps for the lowland region of the River.

10. Restoration of basic natural stream features is a highly important first design step in the re-establishment of any of the native fish to the River (e.g., channel substrates, water quality/flow, channel configuration/complexity). Nevertheless, many of the factors affecting the current extirpation of most native fish in the River extend well beyond the riparian/stream ecotone. We suggest that riparian and riverine native fish restoration designs within the Project’s widened reaches include specific measures (where practicable) for development of: a) water shaded by riparian woody vegetation; b) sediment and leaf-fall inputs to aquatic areas; c) channels with steep native-soil streambanks and in-channel woody debris; d) substantial channel diversity including riffle-run-pool-glide sequences, point bars; e) back channel refugia that utilizes upwelling groundwater (low temperature water of higher quality) and provides protected waters during larger flood flow events; f) appropriate channel substrates, including sand, gravel and cobble; g) potential for some channel movement/meander over time in widened channel areas; h) minimal areas of wide ponded or open water; i) riparian hiding cover for native fish (e.g., herbaceous plants and woody shrubs providing overhanging vegetation on stream banks for hiding cover); and j) target fish species passage and appropriate water temperatures and oxygenation levels, including shading of water surfaces through native tree landscaping on the south side of non-widened channel reaches, where practicable and appropriate. Periodic artificial substrate import (e.g., sand and gravel) into the upper end of the Study Area during the Project life will likely be necessary to maintain some important fluvial processes and conditions for native fish through the Study Area, considering the artificial fluvial conditions of the watershed and upstream channel. The Project should initiate an aquatic exotic species control program for the Study Area: complementary to the level of competitive advantages to native target species provided by the Project (e.g., through channel morphology, riparian cover, etc., as outlined above), periodic direct control of the problematic exotic aquatic species should be implemented in the Study Area, including mosquitofish, tilapia, common carp, green sunfish, fathead minnow, bullfrog, red swamp crayfish (Procambarus clarkii), and other species, as appropriate. The closer the River is restored to natural conditions, the greater the competitive advantage for native species over exotic species, with
concomitantly less control of exotic species needed. Considering the conditions of the watershed and the constraints of the Study Area, it is very likely that periodic control of some exotic aquatic species would be needed in perpetuity in order to maintain native fish and their habitats in the Study Area.

11. Feral mammal populations should be controlled in Project restoration areas, as practicable and appropriate. As part of restoration designs, competitive advantage over exotic mammals should be provided to native species to the extent practicable.

12. Project designs and objectives should include greater specificity regarding minimum levels of ecological functions and values to be created or enhanced. As currently written, the designs, objectives, and criteria are difficult to assess as to the basic or minimum ecological functions that would be gained. We suggest the use of appropriate umbrella species to help briefly outline/translate minimum ecological functions to be restored in meaningful ways, and for planning, design, and implementation purposes.

As such, we suggest that the Project include restoration of specified minimum acreages of functional habitats in the long-term for typical restoration planning species for southern California riparian areas, including vireo, chat, and yellow warbler. These species are excellent umbrella planning species that guide restoration for a variety of currently uncommon or extirpated native riparian wildlife species in the Project area by targeting the necessary components of relatively high-function riparian natural communities with a variety of vegetation structures, densities, and seral stages. For example, vireo, yellow warbler, and chat typically utilize different forms, configurations, and seral stages of riparian scrub/woodland/forests.

13. Any federally listed species occupying the Project footprint should be the subject of consultation under the Endangered Species Act, as appropriate. An unknown number of vireo likely occupy the Project direct activity footprint and would likely be positively affected by the beneficial aspects of the Project and temporarily adversely affected (through loss of habitat and function) by the action’s construction activity of riparian vegetation clearing within seasonally occupied habitat in the River. As such, the action would likely warrant consultation. Appropriate surveys should be performed to determine occupation and usage areas (protocol surveys of the Study Area for vireo have apparently not been performed in the last decade; recent surveys of all appropriate vireo habitat should have been performed and reported during development of the 2013 EIS/EIR). Any listed species expected to be attracted to the Project area that would subsequently be potentially adversely affected by Project operations or maintenance

25 The 2013 EIS/EIR provides a proposed target objective to restore a “minimum of one habitat node with a minimum width of 250 meters (820 feet) to support high frequencies” of vireo. In our opinion this and the other related objectives remain too vague to effectively evaluate the minimum that would be accomplished for target species from an ecological restoration perspective.
should also be monitored and addressed through consultation (for instance, potential translocation and establishment of Santa Ana sucker).  

14. A table describing the various acreages of all of the existing conditions in the Project alternatives’ direct activity footprints should be developed. Only portions of this information were available in the 2013 EIS/EIR in any form. This table (and related map) should describe land uses, wetlands, and natural communities acreages (pre- and post-Project alternative), and should clearly demonstrate the specific biological impacts and gains that would be provided by the proposed Project alternatives, by acreage and natural community/land use type. In this way the Project can be evaluated for what resources would be lost and gained with implementation. We suggest that this be standard practice for most Corps projects.

The Service offers the following related suggestion that is much larger in scope than (and not specific to) the proposed Project:

With the goal of partially restoring greater ecological functions and nature access to the River, the Corps, City of Los Angeles, other local cities, County of Los Angeles, and resource agencies should continue to develop and implement restoration projects along the lengths of the River and its major tributaries. The focus of these projects should be on:

- Re-establishing some substantial areas of former floodplain with partial restoration of riparian natural communities;
- Channel widening and partial restoration of riverine natural communities and natural channel geomorphology and substrates;
- Partial restoration of fluvial and hydrological processes;
- Partial restoration and enhancement of target native species (e.g., arroyo chub) and their various habitats, including linkages and corridors for appropriate indicator/umbrella species (e.g., bobcat);
- Improving water quality, water temperatures, and native fish passage/linkages;
- Improving watershed processes related to contaminants and the natural “spreading out” of stream flow peaks during storm events; and
- Providing unstructured recreation opportunities for people in nature (e.g., see Louv 2011).

26 In email attachment to us dated 25 November 2014, the Corp commented: “Section 5.5.1 of the Draft IFR outlines that Section 7 of the ESA requires consultation with USFWS if adverse impacts to listed species are anticipated. Under Section 10.1 of the Draft IFR, the Corps determined that the proposed project would have no effect on federally listed threatened or endangered species. The Corps will continue to review conditions to determine if endangered species may be present, and coordinate or consult with USFWS as necessary through the design and construction of each project phase/feature. Endangered species surveys will be conducted during the detailed design phase and in the nesting season(s) immediately prior to construction within any potentially suitable areas to confirm presence or absence of federally and state listed threatened and endangered species. The Corps will continue to coordinate with the USFWS throughout the design and construction period, and consult under ESA if necessary.”
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