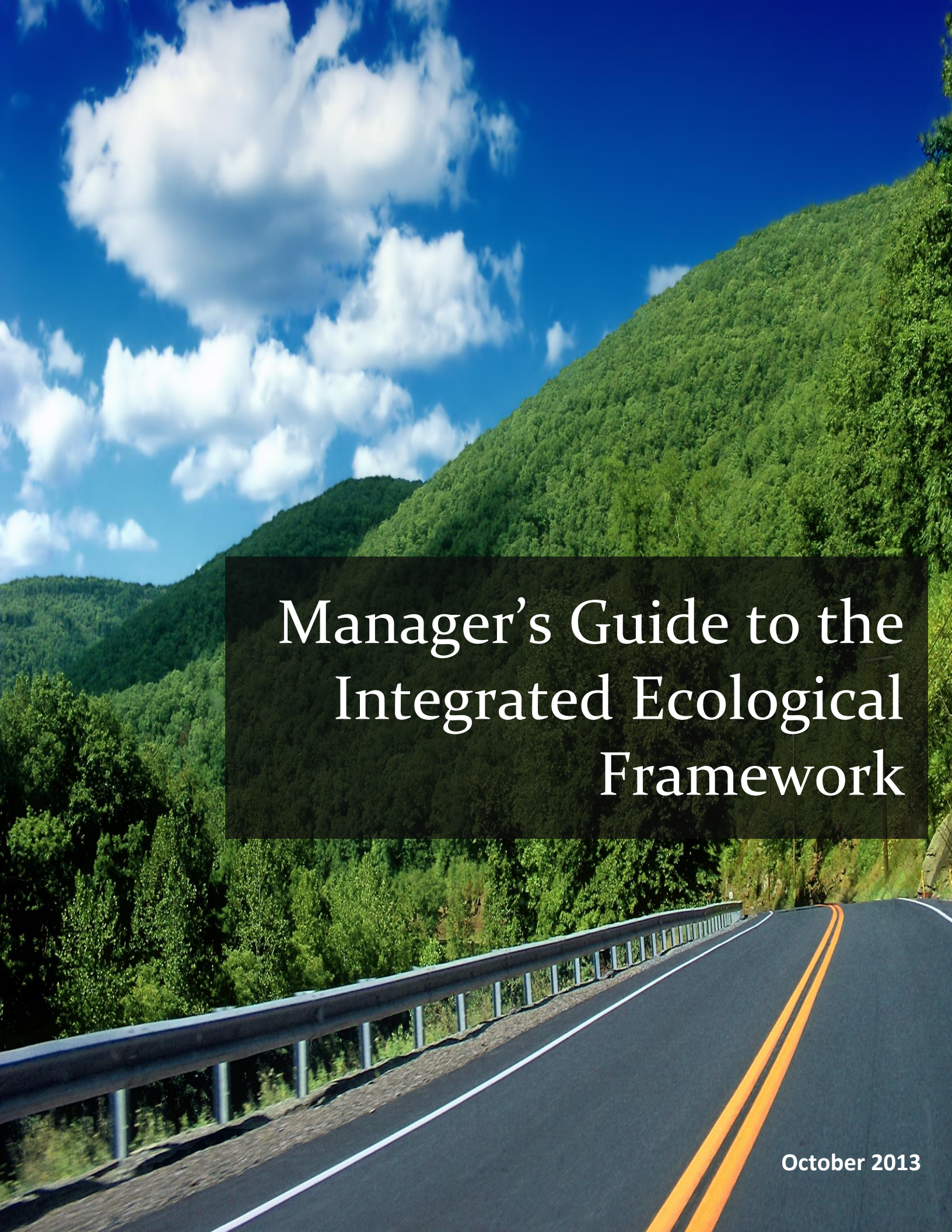

Manager's Guide to the Integrated Ecological Framework

October 2013

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Acronyms and Abbreviations

BISON	Biodiversity Information Serving Our Nation
BLM	Bureau of Land Management
COGs	Council of Governments
CWA	Clean Water Act
DOT	Department of Transportation
DVRPC	Delaware Valley Regional Planning Commission
EEP	Ecosystem Enhancement Program
EO	Element Occurrence
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highways Administration
GAP	Gap Analysis Program
GIS	Geographic Information System
IEF	Integrated Ecological Framework
LCC	Landscape Conservation Cooperative
LWI	Local watershed inventories
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organizations
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NGO	Non-governmental organization
NOAA	National Oceanic and Atmospheric Association
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
PADUS	Protected Areas Database of the United States
REF	Regional Ecosystem Framework
REIDF	Regional Ecosystem and Infrastructure Development Framework
RGP	Regional General Permit
SAMP	Special Area Management Plan
SHRP 2	Strategic Highway Research Program 2

SLAMM	Sea Level Affecting Marshes Model
STIP	State Transportation Improvement Program
SWAP	State Wildlife Action Plan
TCAPP	Transportation for Communities – Advancing Projects through Partnerships
TIP	Transportation Improvement Program
TRB	Transportation Research Board
USDA	US Department of Agricultural
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey

Introduction

Background

There is compelling evidence that integrating regional-scale ecological needs early in transportation and infrastructure planning processes can achieve significant ecosystem, economic, and societal benefits. And many efforts are underway across the U.S. that promote and use these regional-scale ecological needs as part of a more integrated and collaborative approach to transportation and infrastructure planning and project development. These efforts are demonstrating that through early collaboration and proactive identification and response to resource needs, transportation and resource agencies – as well as local and regional governments – can more purposefully avoid and minimize impacts, restore watersheds, and recover species. Prior to these recent efforts, many opportunities to avoid, minimize and contribute to environmental priorities were missed. Regulatory decisions did not require interagency involvement; short-staffed agencies were hard-pressed to find time to provide input on the planning level, and a majority of transportation plans moved forward without considering ecological needs.

Transportation agencies face significant costs to meet environmental mitigation requirements. Over $3.3 billion is spent annually on compensatory mitigation under the Clean Water Act and the Endangered Species Act (ELI 2007). Furthermore, environmental permitting can encompass 3% to 59% of road construction costs (Louis Berger & Associates, Inc. and BSC Group 1997). While these investments are considered "costs" to transportation projects, they represent one of the largest sources of funding for conservation action in the U.S. The potential benefits from a more strategic application of these funds would therefore be enormous, supporting both conservation, and streamlining and cost reduction for transportation improvements.

Realizing the high costs and lost opportunities, a team that represented nine federal agencies produced the publication *Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects* (Brown, J.W. 2006). The Eco-Logical approach recommends a collaborative, integrated, watershed or regional-scale approach to decision-making during transportation and infrastructure planning, environmental review, and permitting that emphasizes using resources more effectively to enhance the environment, species viability, and watershed restoration.

The benefits of integrating regional-scale natural resource or conservation planning and highway planning are widely recognized, but as advances in computing capacity, data, and GIS modeling have made it possible to facilitate better, more informed, and scientifically sound environmental planning, the need for a practical and technical guidance on how to effectively implement these approaches became apparent. This guidance came through a research project funded by the Transportation Research Board's (TRB) Strategic Highway Research Program (SHRP 2) and resulted in the *Integrated Ecological Framework (IEF)* (INR et al 2010).

What is the Integrated Ecological Framework (IEF)?

The Integrated Ecological Framework (IEF) is a peer-reviewed technical guide that provides a step-by-step process for implementing the Eco-Logical approach. It supports transportation planners and natural resource specialists, and uses a standardized, science-based approach to

identify ecological priorities and integrate them into transportation and infrastructure decision making. The IEF draws on well-established and innovative approaches to conservation analyses. In addition, it is informed by efforts currently underway at federal and state natural resource and transportation agencies to address known organizational, process, and policy challenges related to accelerating project delivery while still achieving net environmental benefits. The success of the IEF depends on transportation and natural resource agencies working together to use not only cutting-edge science, tools, and current data, but also their respective expertise in transportation and conservation analyses and implementation.

The IEF is intended to primarily support mid to long-range transportation and infrastructure planning rather than individual project assessment and design. However, by proactively addressing information needs at the regional scale, the IEF supports better project level design, construction, and maintenance. The IEF products lay the foundation for implementing a watershed approach to the Section 301, 303, 401 and, most often, 404 of the Clean Water Act. It also lays the foundation for a regional-scale approach to conservation and consultation under the Endangered Species Act Section 7. Federal agencies have defined these approaches as Strategic Habitat Conservation, or landscape and watershed-based approaches. These ecosystem approaches aim to deliver the greatest benefits under our existing laws and regulations supporting aquatic resource restoration, species and habitat recovery, and greater regional-scale resilience.

The IEF provides science and data-driven technical guidance to ensure that ecological considerations are integrated early in the transportation process.

What is this guide?

This guide was developed for managers and decision makers who want to understand what is entailed in conducting a transportation/infrastructure planning process that involves the appropriate types of stakeholders, information, and expertise to ensure the best transportation/ infrastructure and conservation outcomes possible. This guide does not provide the level of technical detail provided in the SHRP 2 C0A and C06B publications, and it includes some changes to the IEF steps and substeps based on feedback the C06 project team received. All significant changes to IEF steps and substeps are documented in the 'Changes to the IEF' section below.

This guide:

- ✓ moves the reader from *what* the IEF is to *how* to conduct it, providing a high-level description of the IEF steps and technical methods used; and
- ✓ provides practical considerations needed to accurately scope the work and assemble the technical and scientific teams, and stakeholders.

Because transportation and infrastructure planning and delivery can take years, each step of the IEF is described as a discrete effort with prerequisites, inputs, and outputs. It is important to understand that the IEF is meant to be flexible rather than rigid and prescriptive in its implementation since the context and resources available vary by region and state. Not every step needs to be implemented, although some steps are dependent on outputs from other steps. The steps do not need to be conducted in the order presented, and there are several approaches to carrying out each step and

substep; however, there are characteristics that are essential to the successful implementation of the IEF. The following are the core aspects of the IEF that must be in place in order to achieve the goals described in Eco-Logical.

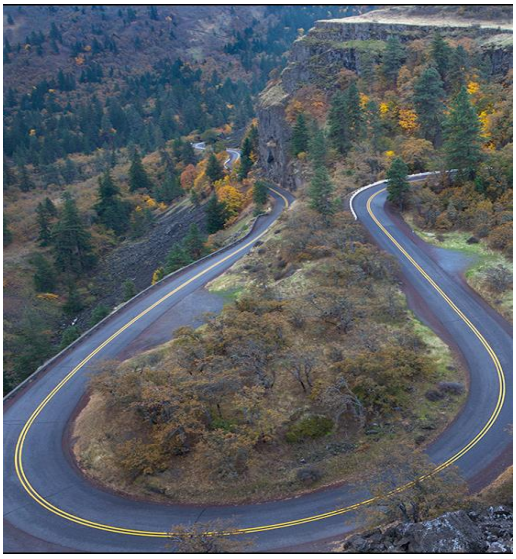
- ✓ Conducting analyses and making decisions within a regional context.
- ✓ Involving stakeholders in the planning region.
- ✓ Clearly identifying the important resources and their conservation requirements.
- ✓ Using a spatially explicit and quantitative assessment approach to planning.
- ✓ Bringing in all the above elements very early in the planning process.

Who should use it?

Anyone interested in obtaining a basic understanding of the IEF and/or is considering implementing it in their agency or organization. Ideally, a partnership among the transportation agency, resource agency, and conservation NGOs who are stakeholders in the planning region should jointly review this guide to initiate IEF implementation.

Beyond the guide

Two more detailed technical research reports on the IEF that provide useful examples, sources, and tools to conduct each step and substep were published by the TRB-SHRP 2 Capacity Research Program, and can be found at the TRB website (http://www.trb.org/Main/Blurbs/169515.aspx, http://www.trb.org/Main/Blurbs/166938.aspx). For an overview of how the IEF fits into the entire transportation planning process go to the Transportation for Communities website (www.transportationforcommunities.com). If additional assistance is desired, a number of organizations can provide assistance, ranging from training to advising to conducting technical work. For more information please contact FHWA (Maryls Osterheus, Marlys.Osterhues@dot.govM).



The Integrated Ecological Framework at a Glance

The Integrated Ecological Framework (IEF) is a peer-reviewed, nine-step technical framework that supports transportation/infrastructure planners and resource specialists in the use of a standardized, science-based approach to identify and integrate ecological priorities into transportation and infrastructure decision making. The IEF draws on both well-established and new approaches to conservation analyses, as well as on existing efforts being led by federal and state natural resource and transportation/infrastructure agencies to address known organizational, process, and policy challenges related to accelerating project delivery while still achieving net environmental benefits.

Benefits of the IEF

- **Supports more coordinated and consolidated administrative and decision making processes** that result in significant time and resource efficiencies for transportation/infrastructure and natural resource agencies.
- **Creates a more efficient and predictable consultation and project development process** by early identification of needs and solutions.
- **Allows for a clearer understanding of regional-scale considerations and opportunities** including goals and priorities, and the potential for impact avoidance or minimization, restoration, and recovery.
- **Directs resources for mitigation** to regional-scale conservation priorities.
- **Provides transparent and measurable processes** that can be duplicated, contributing to better accountability and the ability to measure success.
- **Creates additional knowledge about priority conservation areas** thus driving incentives to develop programs and funding to conserve and restore these areas.

Major IEF products

- **Regional maps of conservation and restoration priorities**.
- **Regional maps identifying affected resources** and the quantification of the direct and cumulative impacts for each transportation scenario being considered.
- **Identification and evaluation of potential mitigation and enhancement areas** within a state or region.
- **A dynamic database of regional resources, goals, gaps, and achievements**.

IEF Steps
Step 1: Build and strengthen collaborative partnerships and vision
Step 2: Create a spatially explicit, regional-scale environmental plan or regional ecosystem framework (REF)
Step 3: Define transportation and infrastructure scenarios for assessment
Step 4: Create a regional ecosystem and infrastructure development framework (REIDF) to assess effects of transportation on natural resources objectives.
Step 5: Establish and prioritize ecological actions
Step 6: Develop crediting strategy
Step 7: Develop programmatic consultation, biological opinion or permits
Step 8: Implement agreements and adaptive management and deliver conservation and transportation projects
Step 9: Ongoing updates to the REF and REIDF

The fundamental objective of the IEF is to support natural resource and transportation/infrastructure practitioners in the process of integrating their vision, goals, and objectives so that they can work together to achieve more efficient, cost-saving implementation of transportation/infrastructure needs while, not only minimizing impacts to the environment, but contributing more effectively to existing environmental goals.

Frequently asked questions

How is the IEF different from other conservation planning frameworks and/or what makes it unique? Although the IEF draws on many existing processes and approaches to planning, it was specifically designed to frame issues and challenges that are unique to integrating conservation and transportation planning, and to provide scientifically-based methods for addressing those issues.

What are the upfront costs to implementing the IEF? It may require more collaboration, information, and analyses upfront; however, using the IEF will very likely yield significant, long-term ecosystem and economic benefits, and cost savings that could possibly outweigh the additional, upfront costs necessary to establish this new regional-scale approach to achieving transportation and ecological goals (NCHRP 2011).

Can the IEF support other regional, ecosystem-based initiatives happening across the country? Yes, and vice versa, especially by directing mitigation actions and resources to identified conservation priorities. The IEF should draw from a variety of federal, state and NGO conservation plans and activities. See the 'Leveraging Existing Resources' section below.

How do you implement different parts of the IEF at different stages of transportation/infrastructure work (in other words, does the IEF have "on ramps")? Can you start the IEF at any step? How can we take advantage of prior work? Although the IEF is presented as a set of nine steps arranged in a linear process, different agencies and regions will have different starting points and needs. The IEF is intended to be flexible with regard to starting point and emphasis, and in reality is a more cyclical process (see Figure 1 and the "On-Ramps" section of this guide). Transportation and resource agencies often begin the IEF with a number of activities already underway, such as development of a Long Range Transportation Plan or State Wildlife Action Plan. These activities are likely to contribute to accomplishing some steps of the IEF. Most of the IEF steps can be done independently, but some steps are prerequisites for the IEF to be successful. For example, steps 1 and 2 are fundamental to the IEF and must be in place since they set the stage for all other IEF steps.

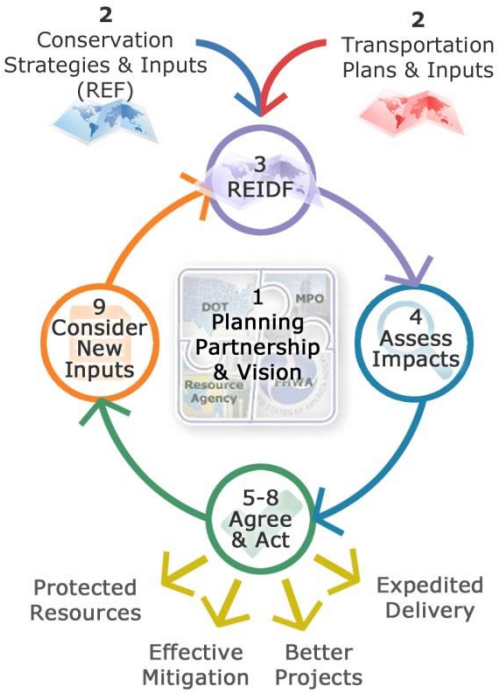


Figure 1: Visual Representation of IEF Steps

What is the core component of the IEF? The Regional Ecological Framework (REF) is the core of the IEF. Essentially, the REF is a spatial database of the resources of interest that should be subject to cumulative effects assessment and mitigation planning and preferably include pre-identified priority areas to avoid or to invest in mitigation (ecological improvement) or restoration actions. The REF represents natural resources as well as the values of partners and stakeholders; and may include other concerns besides ecological resources such as cultural resources and environmental justice (Road Ecology Center University of California, Davis 2012).

How can the IEF help me in the long term? The IEF is intended to be a continuous process, as is transportation/infrastructure planning overall. The key data sets and partnerships of the IEF, maintained over time, can continue to efficiently support assessment and planning into the future. Ongoing maintenance of these data and partnerships will greatly reduce the time and costs needed to keep the data updated, and contribute to improving the accuracy and quality of the results over time.

Overview of the IEF Process

Using the IEF steps outlined below, state DOTs, MPOs, and resource agencies can work together during transportation/infrastructure planning to identify transportation/infrastructure program needs, potential environmental conflicts, and strategic conservation and restoration priorities in the state, ecoregion, or watershed. Based on identified and agreed priorities, partners may choose to develop programmatic approaches that increase regulatory predictability during project development while further achieving regional conservation, restoration, and recovery goals.

Broadening the types and use of data

The IEF process requires that all states use data layers to address the regulated resources such as 303(d)-listed streams, wetlands, and endangered or threatened species which currently drive many transportation and infrastructure decisions at the project level. The IEF, however, seeks to integrate these more traditionally regulatory-oriented datasets used in permitting and consultations with non-regulated resources and data – such as, important habitats, climate impacts and other at-risk species. A broader set of data that is developed and used at a regional scale can:

- ✓ inform early stages of planning and foster improved resource planning and effectiveness,
- ✓ achieve desired environmental outcomes,
- ✓ help avoid additional species listings or expansion of Clean Water Act regulations, and
- ✓ maintain better ecological integrity and build broader stakeholder support.

Leveraging existing resources

Partners should draw upon existing resources, such as the following:

- ✓ State Wildlife Action Plans nationwide, Crucial Habitat Assessment Tools in western states, other regional or state conservation strategies,
- ✓ Existing state, regional or local watershed plans,
- ✓ State Natural Heritage Program conservation sites and priorities,
- ✓ Environmental organization conservation strategies, plans and priorities,
- ✓ Bureau of Land Management Rapid Ecoregional Assessments in western states, and
- ✓ The EISPC EZ Mapping Tool in the eastern 39 states supporting energy planning for the Eastern Electrical Interconnection.

Also note that a national tool is under development to help implement the IEF by providing uniform access to a number of national data portals and basic analytical functions. The tool is being built with Transportation Research Board funding under the TRB SHRP 2 C40 grant (http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3336).

Steps of the IEF

Table 1. Summary of each step of the IEF

Step	Purpose
Step 1: Build and strengthen collaborative partnerships and vision	Build support among relevant stakeholders to achieve a statewide or regional vision and planning process that integrates conservation and transportation/infrastructure planning.
Step 2: Create a regional ecosystem framework (REF)	Develop an overall environmental conservation strategy that integrates conservation priorities, data, and plans, with input from and adoption by all conservation and natural resource stakeholders identified in step 1 that addresses species, habitats, and relevant environmental issues and regulatory requirements agreed upon by the stakeholders.
Step 3: Define transportation and infrastructure scenarios for assessment	Integrate existing, proposed, and forecasted development, transportation/infrastructure, and, optionally, other plans into one or more scenarios to assess cumulative effects on resources.
Step 4: Create an ecosystem and infrastructure development framework (REIDF)	Integrate environmental conservation (REF) and transportation/infrastructure data and plans to support creation of an ecosystem and infrastructure development framework (REIDF). Assess effects of transportation/infrastructure on natural resource objectives. Identify preferred scenarios that meet both transportation/infrastructure and conservation goals by using the REIDF and models of priority resources to analyze transportation/infrastructure scenarios in relation to resource conservation objectives and priorities.
Step 5: Establish and prioritize ecological actions	Establish mitigation and conservation priorities and rank action opportunities using assessment results from steps 3 and 4.
Step 6: Develop crediting strategy	Develop a consistent strategy and metrics to measure ecological impacts, restoration benefits, and long-term performance for all projects to promote progressive restoration and mitigation, and more accurate accounting of results.
Step 7: Develop programmatic consultation, biological opinion or permits	Take advantage of identified regional conservation and restoration objectives to develop MOUs, programmatic agreements (404 permits or ESA Section 7 consultations), or other CWA agreements for transportation/infrastructure projects in a way that documents the goals and priorities identified in step 6 and the parameters for achieving these goals.
Step 8: Deliver conservation and transportation projects	Design transportation/infrastructure projects in accordance with ecological objectives and goals identified in previous steps (i.e., keeping planning decisions linked to project decisions), incorporating as appropriate programmatic agreements, performance measures and ecological metric tools to improve the project.
Step 9: Update regional ecosystem framework, scenarios, and regional assessment	Maintain a current REF that reflects the most recent distribution and knowledge of natural resources, conservation priorities, and mitigation opportunity areas that can support periodic updates to scenarios, and regional cumulative effects assessments.

The following section summarizes the nine major steps in the IEF process. Note that there have been some minor but important modifications to some of the steps presented here since the original TRB publication. Each step below is presented as a discrete task to facilitate different starting points (or "on-ramps" as described below).

Step 1: Build and strengthen collaborative partnerships and vision

Build support among relevant stakeholders to achieve a statewide or regional vision and planning process that integrates conservation and transportation/infrastructure planning.

Implementation

1a. Identify **the preliminary planning region** (e.g., watersheds, ecoregions, political boundaries). The boundary may be influenced by environmental factors such as water quality needs or 303(d) listings, species' needs, watershed restoration needs, or rare wetlands.

1b. Identify counterparts and **build relationships among agencies, including local government and conservation NGOs** (stakeholders). This step will be iterative with step 1a because the boundary will influence the choice of stakeholders and vice-versa.

1c. **Convene the partnership**, share aspirations, define, and develop commonalities. Build an understanding of the benefits of the IEF planning approach and develop a shared vision of regional goals for transportation, land use, restoration, recovery, and conservation.

1d. Record ideas and **develop an MOU** on potential new processes for increasing conservation, efficiency, and predictability through collaborative planning.

1e. **Explore initial funding and long-term management options** to support conservation and restoration actions. This could focus on a near-term, existing issue that must be resolved.

Step 1: Outcomes

An understanding of each stakeholder's goals, priorities, processes and major areas of concern within a specified planning region.

Documentation of significant issues that may impact agency goals and mitigation needs.

A shared regional planning vision.

Formal agreements on roles, responsibilities, processes, and timelines that establish or reinforce partnerships.

Documented criteria and opportunities for using programmatic consultation approaches to better address transportation and conservation planning needs.

Identification of initial funding options

Step 2: Create the regional ecological framework

Develop an overall environmental conservation strategy that integrates conservation priorities, data, and plans, with input from and adoption by all conservation and natural resource stakeholders identified in step 1 that addresses species, habitats, and relevant environmental issues and regulatory requirements agreed upon by the stakeholders.

Step 2: Outcomes

Compilation of existing available data and plans into a refined map that identifies locations of all 1resources of interest and areas for conservation and mitigation action.

An understanding of historic/long-term trends, priorities, and concerns related to aquatic and terrestrial species and habitats in the region.

Identification of any gaps in data that need to be addressed to achieve a complete and reliable product at the appropriate level of resolution and accuracy.

An agreed upon set of conservation and mitigation goals.

Commitments and schedule for delivery of data and actions to fill data gaps.

Implementation

2a. Identify the **spatial data needed to create an understanding of current (baseline) conditions** that are by-products of past actions and allow you to consider potential impacts from future actions.

2b. Prioritize the **specific list of ecological resources and issues** that should be addressed in the REF or other assessments and planning.

2c. Develop the **necessary agreements from agencies and NGOs to provide plans and data** that agencies can use in their own decision-making processes. Agreements should allow data to be used to avoid, minimize, and advance mitigation, especially for CWA Section 404 and ESA Section 7.

2d. Identify **important data gaps** and **how they will be addressed in the combined conservation-restoration plan.** Reach consensus on an efficient process for filling any remaining gaps, both in the short-term for immediate applications and for longer term improvements.

2e. **Delineate priority areas for conservation and mitigation,** if these do not already exist. These should include all of the identified resources and follow principles from systematic conservation planning and should include opportunities for off-site mitigation through restoring habitat.

2f. **Convene a team of stakeholders** to review the draft REF generated from the above steps. Identify any issues that need correction and finalize the REF.

2g. **Document the REF objectives, decisions, and methods** based on stakeholder input, and the technical and scientific methods used in steps 2a-2f above. Document formats should be suitable for GIS metadata, formal reporting, and outreach to support use, updating, and external products.

2h. **Distribute the combined map of conservation and restoration priorities (the REF) to stakeholders for adoption.** Develop and provide a suitable method and online portal for accessing the products that respects any data security and use-limitation agreements.

Prerequisites to conduct step 2

Although some of step 2 can be done before or at the same time as step 1, it is important to identify a strong stakeholders group for a planning region, and have a vision and goals in order to:

- Secure stakeholder buy-in on the REF and its appropriate applications;
- Identify the range of resource and other values that must be included in the REF; and
- Identify data sources and authoritative expertise for the components of the REF.

Step 3: Define transportation and infrastructure scenarios for assessment

Integrate existing, proposed, and forecasted development, transportation, and, optionally, other plans into one or more scenarios to assess cumulative effects on resources.

Step 3: Outcomes

Mapped scenarios that address current and future time frames and include all features and stressors that do or may cause impact to natural resources.

A shared understanding of the current and planned/proposed locations, quantities, and patterns of all development, uses, and resource stressors in the region.

Implementation

3a. **Convene stakeholders and identify appropriate scenarios to represent.** Formal scenario-based planning approaches can be very useful for envisioning, describing, and prioritizing scenarios for assessment. This step should include what time frames to represent (e.g., current, 15 years, 50 years), the scope of information included in the scenarios (i.e., only transportation or in combination with all relevant uses and stressors), and what future assumptions to incorporate and represent in alternate scenarios (e.g., low versus high growth, climate change, transportation funding, etc.).

3b. **Obtain data** to represent the land uses, activities, and other features for each scenario. Specific to transportation, include the Long Range Transportation Plan (or TIP/STIP) and preferably the full set of land use and management plans from the major local, state, and federal regulatory, land management and planning agencies in the region.

3c. **Assemble the draft scenarios** and review with the stakeholders. Note and make corrections as needed.

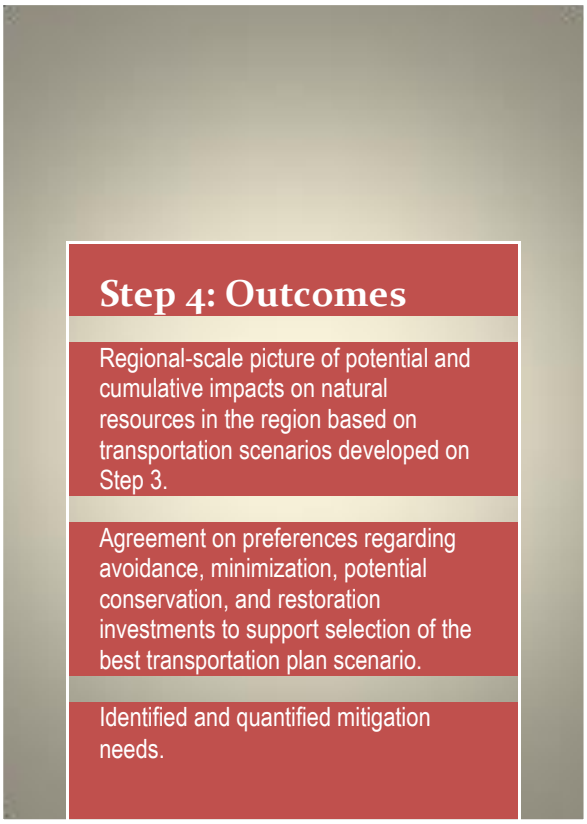
3d. **Provide the scenarios to the stakeholders.**

Prerequisites to conduct step 3

None. However, it will be informative to know which natural resources (steps 1 and 2) will be included in the REF to ensure the relevant stressors are integrated in the scenarios. Having a convened group of stakeholders to inform the implementation steps will also provide a more useful and accepted product.

Step 4: Create an ecosystem and infrastructure development framework (REIDF)

Integrate environmental conservation (REF) and transportation/infrastructure data and plans to support creation of an ecosystem and infrastructure development framework (REIDF). Assess effects of transportation/infrastructure on natural resource objectives. Identify preferred scenarios that meet both transportation/infrastructure and conservation goals by using the REIDF and predictive models of priority resources to analyze transportation scenarios in relation to natural resource conservation objectives.



Implementation

4a. **Work collaboratively with stakeholders** to weight the relative importance of resources where needed to help establish the significance of impacts and importance for mitigating actions.

4b. **Establish individual resource conservation requirements** (e.g., minimum viable habitat sizes, connectivity requirements, etc.) and their response to different types of transportation improvements, and other stressors.

4c. **Create the REIDF** by combining the REF (from step 2) with the scenarios from step 3 to identify which priority areas or resources would be affected, to identify the nature of the effect (e.g., negative, neutral, beneficial), and to quantify the effect – noting the level of precision of mapping inputs. An initial visual overlay of the scenarios with the REF can point to particular problem areas while a quantitative assessment of cumulative effects facilitates better comparison among scenarios and quantifies mitigation needs.

4d. **Compare scenarios** and select the one that optimizes transportation/infrastructure objectives *and* minimizes adverse environmental impacts (the least damaging scenario) or use the results to create a new scenario.

4e. **Identify mitigation needs** for impacts that are unavoidable; may require minimization through project design, implementation, maintenance; and that may require offsite mitigation. For impacts that do not appear practicable to mitigate in-kind, review with appropriate resource agency partners the feasibility of mitigating out-of-kind (e.g., by helping secure a very high priority conservation area supporting other resource objectives).

Prerequisites to conduct step 4

- An REF (step 2) or some comprehensive spatial database of the location of high priority resources that must be assessed.
- Step 3 or spatially explicit transportation/infrastructure data intersected with natural resource data for the plan or project area to be assessed.

Step 5: Establish and prioritize ecological actions

Establish mitigation and conservation priorities and rank action opportunities using assessment results from steps 3 and 4.

Step 5: Outcomes

Developing and agreeing on:

A regional conservation, restoration, recovery, and mitigation strategy, with quantitative and qualitative valuation of mitigation sites.

The preferred conservation/ mitigation actions to achieve the priorities.

Strategies and actions that consider regulatory requirements and programmatic implementation opportunities.

Crediting opportunities (see Step 6).

Identify lead agency or agencies for each strategy and method for achieving each strategy.

Implementation

5a. Using results from step 4, identify **areas in the REF planning region that can provide the quantities and quality of mitigation** needed to address impacts from the cumulative effects assessment and develop protocols for ranking mitigation opportunities. Ranking should be based on the site's ability to meet mitigation targets, along with: a) the anticipated contributions to cumulative effects; b) the presence in priority conservation/ restoration areas of the REF; c) the ability to contribute to long-term ecological goals; d) the likelihood of viability in the regional context; e) cost; and f) other criteria determined by the stakeholders.

5b. Select **potential mitigation areas** according to the ranking protocols described above. Create a new scenario (repeat step 3) specifying the mitigation actions for selected sites and re-evaluate the mitigation scenario (repeat step 4) to validate that the expected mitigation benefits can be achieved. The development of a comprehensive REF in collaboration with regulatory agencies should expedite this step since the priority mitigation areas would already be designated by these agencies reducing the time it takes to select and move forward on mitigation efforts that are more likely to contribute to high priority conservation needs.

5c. **Field validate the presence and condition of target resources** at the mitigation sites and reassess the ability of sites to provide necessary mitigation. Revise the mitigation assessment, as needed, to identify a validated set of locations to provide mitigation. Compare feasibility and cost of conservation and restoration opportunities with ranking score (as described in 5a) and context of conservation actions of other federal, state, local and NGO programs to determine overall benefit and effectiveness. Predictive species modeling can target areas for the field validation process.

5d. Develop/refine **a regional conservation and mitigation plan and strategy** to achieve ecoregional conservation and restoration goals, and advance infrastructure projects. This should address timing of actions related to when impacts are expected to occur and the urgency to secure mitigation sites before they are developed or used for other mitigation actions.

5e. Obtain **stakeholder agreement on mitigation implementation actions**.

Prerequisites to conduct step 5

- Step 4 cumulative effects assessment and its prerequisites.

Step 6: Develop crediting strategy

Develop a consistent strategy and metrics to measure ecological impacts, restoration benefits, and long-term performance for all projects to promote progressive restoration and mitigation, and more accurate accounting of results.

Implementation

6a. **Diagnose the measurement need.** Define which ecosystem services need to be measured or which could be beneficial and straightforward to measure. Examine the regulated ecological services potentially impacted by transportation/infrastructure projects in the watershed or REF area, as well as the services provided by non-regulated ecological resources identified in the REF.

6b. Identify **ecosystem crediting protocols** developed within the region and evaluate their applicability to resources identified as priority within the REF.

6c. Select or develop **units and rules for crediting.** If there are existing functional or conditional assessment protocols available, these are useful for consistent measurement of ecological functions or services. These are also used in the establishment of mitigation or conservation banks, and can be used to define outcome-based performance standards. When these assessment protocols do not exist, protocols for the most similar landscapes and ecosystems may potentially be adapted. If assessment protocols are available, step 6d can be skipped.

6d. Test **applicability of functional or conditional assessment methods for local conditions** if new rules or methods for service measurement or crediting are developed (or adapted from other regions). This includes a review of the rules by the primary regulatory agencies along with other important stakeholders.

6e. Evaluate **local market opportunities for ecosystem services.** Currently non-regulatory markets are limited, but carbon and other markets may be available soon, and this can provide opportunities for more effective mitigation banks.

6f. Negotiate **regulatory assurances to grant credits and long-term agreements,** after determining regulators have this capacity. If information in the IEF and the overall mitigation plan demonstrates sufficiently that the critical regulatory elements are properly addressed, and are being used to drive regional and watershed priorities, then it is possible for DOTs and MPOs to have regulatory assurances integrated into their crediting system.

Step 6: Outcomes

Improved and integrated mitigation sequence at a site level, setting the stage for compensation through outcome based performance standards

Supported implementation tools such as advanced mitigation banks, programmatic permitting, and ESA Section 7 consultation.

Supported use of offsite mitigation and out-of-kind mitigation where appropriate, since equivalency of value can be determined across locations and resources.

Informed adaptive management and updates of the cumulative effects analyses.

Measurement of gains and losses of ecological functions, and benefits and values associated with categories of transportation improvements or specific project-related impacts

Characterized project mitigation benefits related to currently unregulated services, such as carbon storage or late season water provision.

Means to track progress toward regional ecosystem goals and objectives.

Prerequisites to conduct step 6

- Regional mitigation strategies and other outcomes from step 5 can significantly reduce the time and effort involved in step 6.
- Many states have ecological function and service based biological inventory methodology included in their regulatory framework (such as Rapid Wetland Assessment Protocols), which have been developed to measure ecological functions and services. When these types of methods are adopted by the regulatory agencies, it can provide a critical head start to implementing step 6.

Step 7: Develop programmatic consultation, biological opinion or permit

Take advantage of identified regional conservation and restoration objectives to develop MOUs, programmatic agreements (404 permits or ESA Section 7 consultations), or other CWA agreements for transportation/infrastructure projects in a way that documents the goals and priorities identified in step 6 and the parameters for achieving these goals.

Step 7: Outcomes

Agreement on resource management roles and methods.

Outcome-based performance standards incorporated within programmatic agreements.

Programmatic ESA Section 7 consultation, Special Area Management Plan for wetlands, Regional General Permit, or agreements that enable agencies to proceed with conservation or restoration action in line with CWA Section 404 and ESA program objectives/requirements and with maximum assurance that investments count and will be sufficient.

Implementation

7a. Identify **actions to programmatically benefit regulated resources** and ensure agreements are documented related to avoidance and minimization of impacts to regulated resources.

7b. Plan for **long-term management** and make arrangements with land management agencies/organizations (e.g., land trusts or bankers) for permanent protection of conservation and restoration parcels. Notify and coordinate with local governments for supportive action.

7c. Design **performance measures for transportation/infrastructure projects** that will be practical for long-term adaptive management and include these in any Section 7 Biological Assessment or Biological Opinion. While Clean Water Act (particularly related to Sections 303 and 404) have not historically included performance measures, they have been successfully used in some programmatic agreements, and should be evaluated.

7d. Choose a **monitoring strategy for mitigation sites,** based on practical measures above, ideally using the same metrics as those used for impact assessment, site selection, and credit development.

7e. Develop programmatic ESA Section 7 consultation, Special Area Management Plan (SAMP), Section 404 Regional General Permits (RGPs), or other **programmatic agreements to advance conservation** action in line with CWA Section 404 and ESA program objectives/requirements and with maximum assurance that conservation/restoration investments by DOTs will count.

7f. Set up periodic **follow-up meetings with stakeholders** to identify what is working well, what could be improved.

Prerequisites to conduct step 7

- Development of an REF, at least for resources under federal regulation.

Step 8: Deliver conservation and transportation projects

Design transportation/infrastructure projects in accordance with ecological objectives and goals identified in previous steps (i.e., keeping planning decisions linked to project decisions), incorporating as appropriate programmatic agreements, performance measures and ecological metric tools to improve the project.

Implementation

8a. Design/implement methods to **complete transportation/infrastructure project(s)** consistent with the mitigation scenario, conservation/restoration strategy, and agreements.

8b. **Identify how advance mitigation/conservation will be funded**, if this has not been done already.

8c. As needed, **develop additional project-specific, outcome-based performance standards** related to impact avoidance and minimization, to ensure full credit for conservation action.

8d. **Minimize unavoidable impacts to resources in the final design of transportation/infrastructure projects**, using conservation and transportation/infrastructure design experts, and tracking via performance measures (e.g., acres of habitat or wetlands)

8e. Use **adaptive management** to ensure maximum long-term benefit of conservation investment and compliance with requirements and intent of performance metrics.

Step 8: Outcomes

Continuity from early planning processes into project implementation phase.

Tools and approaches incorporated into a monitoring and adaptive management strategy.

Accurate recordkeeping and tracking of all commitments by transportation agency in project delivery.

Updated information from construction and operation into the current scenario.

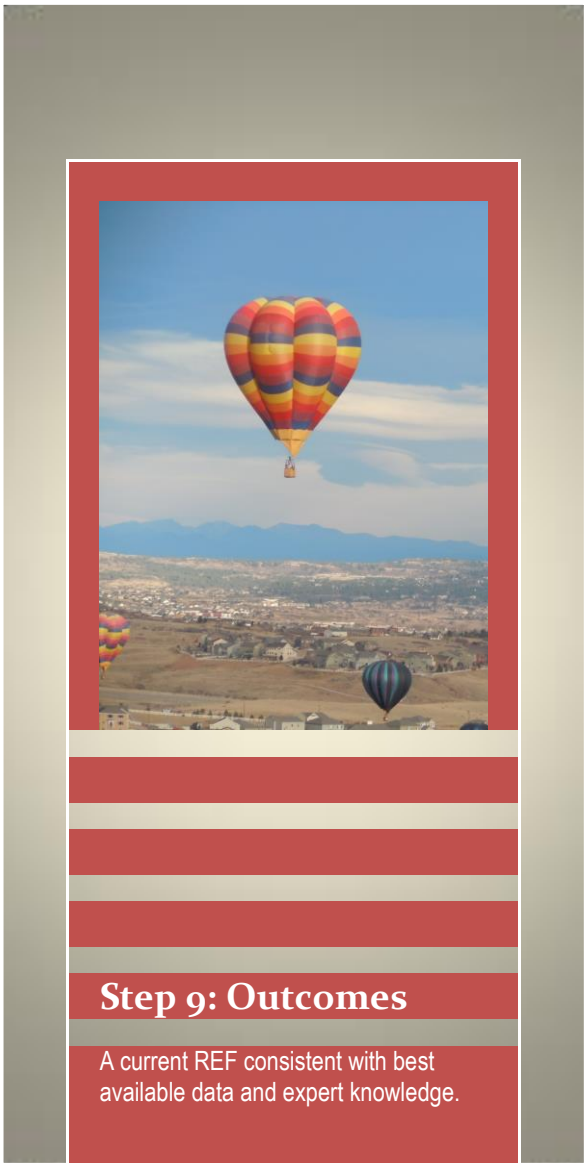
Ability to measure performance success in project delivery.

Prerequisites to conduct step 8

- Although some aspects of step 8 are currently conducted outside of the regulatory compliance process, using the information and objectives of the IEF would ensure better transportation and conservation results and would therefore require performing steps 2-7 of the IEF.

Step 9: Update regional ecosystem framework, scenarios, and regional assessment

Maintain a current REF that reflects the most recent distribution and knowledge of natural resources, conservation priorities, and mitigation opportunity areas that can support periodic updates to scenarios, and regional cumulative effects assessments.



Implementation

9a. **Integrate any new or revised conservation plans into the REF** and, where appropriate, update spatial information of individual natural resources.

9b. **Update the conservation area/resource requirements, responses, and indicators** in response to new research and data, and results of management actions and performance measures (e.g., assess regional goals, update to minimum required area for species and/or habitat, review weighting values of resources in REF, and evaluate responses to stressors).

9c. **Update the implementation and performance status of mitigation areas** (conservation/restoration investments that have occurred) in the REF to evaluate whether those areas are contributing to REF goals and priorities. This will identify whether a mitigation area should be re-categorized as an established conservation area for specific resources or if it is still available for future mitigation action.

9d. **Update the scenarios and the regional cumulative effects analysis** with new infrastructure or ecological developments and/or disturbances, proposals, and trends (e.g., ecosystem-altering wildfire, new policies, plans, proposals, and trends, such as new sea level rise inundation models).

9e. Conduct **regular review of progress**, including effectiveness at meeting goals and objectives, current take totals, and likelihood of exceeding programmatic take allowance.

Prerequisites to conduct step 9

- An existing REF (step 2).
- New information on resource distribution (update to step 2), expert knowledge about resource conservation requirements and response to stressors (update to step 4).

On-ramps: Applying the IEF to current transportation activities

For transportation/infrastructure activities that are already in-process, there are numerous points of entry into the IEF process:

- ✓ **Prioritizing projects for the TIP.** When evaluating projects in the transportation improvement program (TIP) the impacts and the overall benefits that may be achieved can be considered in order to understand and prioritize which projects offer the most benefits and fewest impacts, environmentally. This on-ramp would act as step 3 of the IEF; conducting steps 2 and 4 (even if in a rudimentary way) would provide the assessment necessary to contribute to the TIP prioritization process.

- ✓ **Corridor plans.** When a corridor is considered for a transportation route, that which could be impacted inside and along the right-of-way is analyzed. Examination of the larger context, using the a Regional Ecosystem Framework (REF), allows visualization of the entire range of species and resources and the potential impacts to them across the region or state, and reveals where agencies can act to jointly contribute to existing conservation and restoration priorities. Thus a corridor analyses could be an on-ramp to step 4 assuming that an REF (step 2) or partial REF is already in place.

- ✓ **Transportation project review.** Like TIP prioritization, this on-ramp provides a scenario, in the form of a project to assess. Therefore, IEF steps 2 and 4 would provide the information for project review. If necessary these steps could be limited in scope to the area around the project versus region-wide for time efficiency.

- ✓ **Mitigating a project underway.** Project mitigation requires an understanding of what impacts are expected or documented and what opportunities exist for mitigation. This requires IEF step 2 in some form. If impacts are already documented, step 4 may not be necessary (to quantify impacts) although understanding the ramifications of those impacts in a regional context and against regional conservation goals would help prioritize and direct mitigation actions to ensure these funds are spent to achieve the greatest benefit. The focus on step 2 will be identifying areas of mitigation investment that can be linked to project impacts and are recognized high priorities that are contributing to larger conservation goals. For example, if project impacts are primarily on wetlands, step 2 could focus on identifying areas of the same wetland or a more significant type, preferably within the project watershed, where mitigation would result in the conservation or restoration of a large, intact, high quality wetland community.

Getting Started

Determining your starting point in the process is critical and will have considerable bearing on how you begin implementing the IEF. With that in mind, following are the basic steps to launch the IEF process. Though these steps are presented sequentially, there are necessarily some concurrent and iterative aspects to conducting them.

1. **Secure partner commitments.** Because contributions of partners (expertise, funding or in-kind) can greatly affect the budget and activities such as project extent, scope, and the need for coordination meetings, it is important to establish who the partners are and what they are contributing and expecting.

    - ✓ **Benefits of a multi-partner project**. Overall and individual costs savings by distributing costs over multiple partners; gaining access to a broader set of knowledge, data, and expertise which may streamline many tasks and allow them to be conducted through in-kind contributions

The IEF…

- is highly scalable.
- can be time intensive and span a long time period coincident with transportation planning cycles.
- would be conducted over several years with intervening updates and iterations requiring varying levels of involvement by specific participants depending on what step is being implemented at any point in time.

2. **Scope the project.** A general scoping developed either internally or with partners is needed to determine the higher-level criteria for the project with an understanding of the approximate resources available. A detailed technical scoping of deliverables, budget, and schedule may be completed by appropriate internal and partner staff, or by a consultant using relevant portions of the SHRP 2 C06 Technical Report.

    - ✓ **Consider what is really needed** in terms of products to make decisions, the level of precision required of the data, results, and the available time, funding, and staff capacity.
    - ✓ **Define the geographic extent of the project.** There are no hard and fast rules for defining the planning region extent. These can include planning jurisdictions (e.g., an MPO), watersheds, or be organized by ecological resources and processes. However, the size of the planning region must be manageable relative to the desired precision of spatial products and the computing power needed to process information at the desired resolution. For example, a very large region may require sacrifices in spatial detail and limit the utility of outputs for some purposes.
    - ✓ **Build in excellent documentation & data management**. Most projects intended for broad and long term utility fail because they lacked adequate attention to (and funding for) documenting all decisions, inputs, methods, and outputs and lacked the ongoing data management necessary to keep the inputs and outputs available and current. By investing in these items during the course of the project and thereafter, costs for accessing, updating, and applying the information in the future will be minimized.

3. **Obtain funding and specific in-kind commitments.** Failure to reach the estimated funding needs can result in negotiating additional in-kind support or re-scoping the project within available resources.

4. **Assemble the team.** The project team was described earlier; in this step, contracting (if needed) is completed and the team members are assembled into the desired project team structure (e.g., thematic work groups).

   The **Partners Team** provides leadership and direction to the other teams to ensure that their common and accepted objectives are met. Partners represent the agencies and organizations investing in the project.

   The **Science Team** ensures that the REF represents best available scientific knowledge, makes recommendations about the natural resources that should be included in the REF and populates the REF with information about the resources' conservation requirements and response to stressors that would appear in the transportation and land use scenarios. Because all knowledge cannot be integrated into the REF, the team should also be engaged to review and validate assessments and inform decisions. The team itself is composed of subject matter experts for the resources and may be drawn from state and federal agencies, universities, and NGOs among others.

   
   Photo: Patrick Crist.

   The **Technical Team** manages and conducts the technical work of the IEF. A single project team member may have more than one of the necessary skill sets; for example, a staff member managing the project may also facilitate the partnership. IEF partners may have internal capacity to cover these skills or they may need to look to an external contractor for some roles.

   - **Project Manager** oversees all aspects of the project, assuring participants understand and perform their roles, secures bids, and manages consultant contracts, coordinates all communication, and manages the budget and schedule.
   - **Facilitator** leads and facilitates meetings of the partnership and stakeholders.
   - **Science Lead** coordinates input of the Science Team consistent with direction of the project leadership.
   - **GIS/Data Manager/Lead** oversees all spatial data management and GIS work. May be same position as the individual conducting geospatial analyses (see below).
   - **GIS Analyst** acquires and processes data, conducts all geospatial analyses, develops interpretive products, presents results, and writes methods and documentation. For projects pursuing advanced modeling, a broader team of analysts/modelers will be required.

5. **Initiate the project.** Initiating the project will depend upon what starting point (or on-ramp as described earlier) will be used but will most likely require a kickoff workshop of relevant partners. At this workshop, team members and partners are introduced; purpose, objectives, and scope are reviewed; initial information and findings are presented for discussion and initial decisions about next steps are made. Plenty of time should be allotted for this workshop as participants will likely have many questions requiring explanations, presentations, and discussion.

   - ✓ **Research existing work and determine your starting point.** Carefully considering what work has already been accomplished on each IEF step will reduce duplication of effort - saving time, resources, and partner frustration. Research existing work for the area to understand what relevant data and analyses already exist. This activity should be done early and should inform all IEF steps.

Practical Considerations

Ecosystem-based mitigation approaches

The IEF promotes the use of mitigation approaches that are more successful in supporting environmental needs, and in the long-term reduces impacts and – potentially - the number of environmental permits needed. Below are just a few reasons why using a broader scale, ecosystem-based approach to selecting mitigation sites can improve the site selection process and reduce expenses.

- Compensatory mitigation sites located in close proximity to conservation or protected lands can contribute to increasing a created, enhanced or restored wetland's success in compensating for losses by increasing its connectivity, size, and overall contributions to wetland functions in that watershed (Kramer and Carpenedo, 2009).

- Compensatory mitigation approaches that use information about biophysical systems and consider multiple resources to evaluate the site are most likely to yield the highest number of ecologically valuable outputs (NCHRP 2011).

- Using consolidated, off-site compensation options, supported by a regional-scale approach to mitigation may provide ecological economies of scale like the increased protection afforded to species by larger, unfragmented habitat patches (Murcia 1995, Schwartz 1999, Drechsler and Watzold 2009).

Ecosystem services

In addition, although the societal value of ecosystem production functions is rarely taken into account in the selection and design of compensatory mitigation projects (Ruhl and Gregg 2001, NCHRP 2011), they provide valuable ecosystem services to people close to these conservation areas (Engel et al. 2008). Wetlands are well-known for their ability to filter excess pollutants and nutrients, reduce flood hazards, absorb storm surge, and provide unique recreational or scientific opportunities (Mitsch and Gosselink 2000, Zedler 2003). Economic valuation studies have found that wetlands also can generate aesthetic benefits (Mahan et al. 2000) contributing to an increase in property values (Doss and Taff 1996, Greenspace Alliance and DVRPC 2011); thus wetlands in close proximity to larger housing communities have increased economic value.

Savings in administrative and transaction time

The IEF process supports more coordinated, efficient decision making among transportation and regulatory resource agencies, as well as consolidation of regulatory permitting and consultation processes. In addition to integrated processes, collaborative, ecosystem-based approaches to compensatory mitigation encourage increased use of consolidated, off-site compensatory mitigation sources, such as mitigation banks, conservation banks, or in-lieu fee mitigation programs, presenting opportunities to capture economies of scale and reduce compliance costs for regulatory permittees (U.S. Department of Defense and U.S. Environmental Protection Agency 2008; U.S. Fish and Wildlife Service 2003).

Leveraging resources and reducing litigation

Programmatic mitigation uses processes that support a collaborative, regional-scale approach to mitigation. These collaborative, holistic, regional-scale approaches allow transportation and resource agencies to eliminate redundant investments, share data, and identify potential mitigation sites more effectively. This, along with the use of consolidated, off-site compensation, can reduce field site visits, and time spent approving and monitoring mitigation sites. Collaborative, regional-scale approaches to mitigation also lower overall financial expenses by establishing regulatory assurances, thus reducing vulnerability to litigation or punitive damages, while also allowing transportation agencies to more accurately forecast expected project costs and their associated environmental compensation components (Brown 2006, NCHRP 2011).

There are many examples of transportation programs that have adopted a streamlined, regional-scale approach to infrastructure planning and experienced substantial transaction cost- and time-savings as compared to traditional, project-by-project compensatory mitigation. In 2001, for example, the North Carolina Department of Transportation reported that 55 percent of its transportation developments were delayed by wetland mitigation requirements; after ramping up streamlined transportation planning and mitigation through their Ecosystem Enhancement Program (EEP), there were no delays in Transportation Improvement Projects associated with EEP. (Venner Consulting and URS Corporation 2013). The regional-scale approach to the compensatory mitigation process can generate significant ecological conservation, economic, and societal benefits. The IEF process also increases the effectiveness of existing planning and environmental assessment processes and may reduce the need for later onsite work through avoided impacts.

Other considerations

Drawing on experience from pilot IEF (or similar) projects, guidance on the time, cost, staffing expertise, and information needed to conduct core parts of the IEF are summarized here, along with key suggestions effectively and efficiently conducting the IEF. Experience has shown that initially there is an increased investment needed to create a multi-agency collaborative partnership and a robust REF, but these investments will make decision-making more efficient and outcomes more effective, likely saving costs in the longer term. The IEF process can be readily adapted to fit the needs and resources available to a particular region but there are several factors that need to be considered that will impact the time, effort, and cost to conduct the IEF:

- Time frame within which results are needed to inform a planning effort with a set deadline
- Resources required for the desired level of effort and currently available resources including DOT/MPO funds, partner funds, and in-kind contributions to initiate the work
- Existing staff capacity and expertise and availability of resources to supplement with outside expertise if needed
- Geographic scope and complexity of the project
- Availability of existing relevant analyses, data, and other information and important information gaps that need to be filled

- Available hardware and software (although with the increasing availability of basic GIS capability within many agencies, this is a less-frequent limitation)
- Number of partners and the relative benefits of their participation and contributions (a larger number of partners increases the complexity of coordinating the partnership and making decisions)

Time frame

As with many broad collaborative and data-driven projects, implementing the IEF can be time intensive and require an extended commitment of time. Focusing on developing the REF, scenarios, and initial cumulative effects assessment (IEF steps 2-4), often takes between 12 to 18 months. This time frame does not take into account the partnership building phase (step 1) and assumes there is a core, dedicated team and that staff and other experts can provide timely inputs and review so the technical work can progress without delays.

Cost

As with Time frame, there are a large number of variables affecting the cost of the IEF. Focusing on IEF steps 2-4, an estimate of $150,000–200,000 (2012 dollars) is not unreasonable. This amount will only cover the direct costs for technical and ecological services. Direct costs can be greatly reduced through in-kind contribution of science and technical services by partners. Costs should be shared among the multiple partners that would benefit from this work.

Key information inputs

Information needed to conduct an IEF includes spatial and non-spatial data from a large variety of sources depending on the nature and location of the region. The TRB SHRP 2 C06(B) project technical report (http://www.trb.org/Main/Blurbs/166938.aspx) provides much more detail on specific data and sources for each step, and Table 1 provides a general summary of the types of data needed and ideas for information gathering, highlighting where these efforts may be challenging and require thoughtful budgeting.

Updates to the IEF

The original TRB published 'Guide to the Integrated Ecological Framework' (hereinafter referred to as 'original IEF Guide') is a very detailed technical guide to the IEF. On the other hand, this Manager's Guide to the Integrated Ecological Framework (IEF) or IEF Manager's Guide is a more concise summary of the IEF to assist management level decision-makers understand how the IEF might benefit their region or state, and things they would need to consider if they were to being its implementation.

As mentioned in the 'What is this Guide?' section of this report, the C06 project team received feedback on the IEF since its publication in 2012 (http://www.trb.org/Main/Blurbs/169515.aspx, http://www.trb.org/Main/Blurbs/166938.aspx). A majority of the feedback received was from the SHRP 2 C21 projects which tested the IEF in four geographic areas - California, Colorado, Oregon and West Virginia. Below we document all the changes, and the reason for each change. In some cases changes were made to the language to add clarity, and in other cases substantive technical changes were made to address feedback that the C06 team received on the original IEF documented in the original IEF Guide.

Summary of substantive IEF updates

The most significant change to the IEF from the original IEF Guide are the changes to Steps 2-4. In the original IEF Guide, Step 2 is the integration of environmental and natural resource plans and data guided by experts in the various fields of natural resources and environmental conservation, and in Step 3 a Regional Ecological Framework (REF) is created by overlaying the results of Step 2 with transportation plans and data, and in Step 4 the results of Step 3 (REF) are analyzed collaboratively by transportation and natural resource experts, and other stakeholders identify in Step 1.

In this IEF Manager's Guide, the REF is redefined as the product resulting from the process completed in the original Step 2, and then Step 3 becomes the process of integrating transportation data, plans and expertise, and Step 4 becomes the integration and analyses of the conservation and transportation strategies together resulting in a product that is newly titled Regional Ecological and Infrastructure Development Framework (REIDF).

Appendix A provides a detailed comparison of each step showing changes from the original version of the IEF Guide

The summary below focuses on data that is available nationally, and especially recommended is data in a standardized format so that it is comparable across jurisdictional boundaries and thereby supportive of regional-scale planning.

Table 1. Key national information inputs, sources, and comments

Information Type	Typical Sources	Comments
Species	State wildlife division databases, NatureServe and state natural heritage programs nationally standardized species location data, or element occurrence (EO) data, NatureServe's national animal distribution maps, Critical Habitat Designations (USFWS), USGS Biodiversity Information Serving Our Nation (BISON) species observations, USGS GAP Analysis animal distribution maps.	Includes known and predicted species locations. The use of species distribution modeling software is recommended to generate maps of the probable locations for listed and endangered species, other key species, and areas that may be priorities for restoration and recovery. National broad scale maps may be available for many other species of conservation concern.
Habitats and Ecosystems Data	National Wetlands Inventory (NWI), local watershed inventories (LWIs) or plans by state or local organizations or municipal water supply, e.g., Wetlands of Special State Concern, Impaired (303 d listed) streams (EPA, state agencies) USGS Gap Analysis Program, Landscape Conservation Cooperatives (LCCs), EPA EnviroAtlas, NatureServe nationally standardized ecosystem and vegetation community data	Many existing wetland maps are incomplete and/or inaccurate; regional or state efforts to improve these maps are underway in some states but need to be done across the country. GAP vegetation data and landcover data are generally available nationally, but downscaling it to ecological systems maps to more localized habitat maps may be needed or desirable in many locations.
Resource conservation requirements	Expert knowledge is the primary source; some useful information can be found in scientific literature or technical reports	It is a substantial effort for biologists from natural heritage programs, other agencies, and universities to establish thresholds, goals, indicators, etc. for resources. Plenty of time should be planned for this activity since this information is critical to accurate planning and performance measures.
Current physical stressors, land use, infrastructure data	DOTs, MPOs/COGs, local government planning offices, NRCS, NOAA-Coastal Change Analyses Program, Department of Defense, US Energy Information Administration, Federal Energy Regulatory Commission (FERC), and other infrastructure data sources	This information is typically readily available but must be assembled from multiple sources if a previous project has not yet done that.
Natural resource management plans	Local government planning offices, and state and federal land management agencies	These plans generally represent potential near term future (e.g., next 10-25 years) priorities and goals. These plans should be integrated and/or coordinated with each other. Coordination with other NGOs and universities involved in the development of protected area data and conservation priority area data can assure you have the most accurate and complete set of data.

Information Type	Typical Sources	Comments
Current protected and managed lands	US Protected Area Database (PADUS), National Conservation Easement Database, federal, state, and local agencies, NGOs/land trusts that hold protected lands, mitigation banks	Currently protected area data is not being comprehensively and standardly tracked across the country but is getting better. This data is critical to understanding the level of protection currently afford to species and habitats. Thus more accurate, current and complete data on protected areas gathered locally can significantly improve the analysis.
Conservation priority areas	State Wildlife Action Plans, state natural heritage programs, conservation NGOs (e.g., The Nature Conservancy, Ducks Unlimited, Audubon, etc.), local conservation NGOs and land trusts	Data for this theme must be carefully scrutinized to determine its match to the resources of interest and appropriate scale to be meaningful for analyses. Statewide and ecoregional prioritization efforts tend to generate very coarse maps that may not be useful for IEF purposes.
Climate change stressors data	USGS Regional Climate Science Centers, universities, Climate Wizard**,** Sea Level Affecting Marshes Model (SLAMM) outputs, NOAA Sea Level Rise Viewer	The IEF does not formally address climate change but this is becoming a common requirement in many planning activities. Downscaled climate change data and secondary effects models (e.g., soil moisture changes) are highly dynamic but are increasingly being developed more consistently and at finer scales. For coastal areas, FWS has invested in generating SLAMM analyses for many areas.
Other stressors (e.g., invasive species, wildfire)	Landfire program, BLM Rapid Ecoregional Assessments in the west, U.S. Forest Service, USGS, NatureServe, natural heritage programs, universities	The IEF does not require this information but it will provide a more accurate cumulative effects assessment for many resources. Often development is a much less important stressor than these types. This information is highly variable in its availability nationally. Effort should be expended to research its availability locally and consider modeling efforts to generate it. If modeling is needed, the effort required may be substantial, especially in combination with climate change forecasts.

Glossary

B

Baseline Conditions: The baseline conditions are the physical, chemical, biological, social, economic, and cultural setting in which the proposed project is to be located, and where local impacts (both positive and negative) might be expected to occur. (Quantifying Environmental Impact Assessments Using Fuzzy Logic, Richard B. Springer, 2005, pages 27)

Best Available Data: Under the Endangered Species Act the use of 'best available data' is required. The way best available data is determined is subjective, and typically done on a case-by-case basis by experts in agencies and organizations, and should involve an evaluation of the currency, completeness and quality of data needed. Typically the best available data must be acquired from more than one source to achieve the highest level of currency, completeness and quality.

Biological Inventory: A process of cataloging plant, animals, and/or habitats occurring in an area.

Biophysical Systems: Any biological process which is studied on a system level.

C

Clean Water Act (CWA) Section 404: The Federal Water Pollution Control Act, known as the Clean Water Act, is a comprehensive stature aimed at restoring and maintaining the chemical, physical, and biological integrity of the Nation's waters. Authority for the implementation and enforcement of Section 404 of the Clean Water Act rests with USACE and EPA for the discharge of dredged or fill material within waters of the U.S. (*33 USC ss/1251 et seq*)

Compliance Costs: A compliance cost is expenditure of time or money in conforming with government requirements such as legislation or regulation.

Compensatory Mitigation: *Compensatory mitigation* means the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved. (33 CFR § 332.2)

Conservation Analyses: The complete set of activities involved in creating the Regional Ecological Framework, cumulative effects assessment, and conservation and mitigation planning.

Conservation Planning: Identifying a set of conservation objectives for an area; typically with a goal to identify the set of sites that maximizes representation of distinct species and communities while minimizing the area to be protected (modified from Kareiva and Marvier 2011).

Conservation Requirements: The quantitative and qualitative parameters of what is needed to conserve or maintain a species, ecological system, or other biological resource within a geography of interest. An example of a conservation requirement is the minimum size of a resource occurrence that is needed for the occurrence to persist.

Consultation: The transportation conformity rule requires that agencies including EPA, DOT, State DOTs, State and local air quality agencies, and MPOs collaboratively develop effective interagency consultation procedures (40 CFR §§93.105 and 93.112). The interagency consultation process must include the following three components as well as conformity criteria and procedures as noted above:

1. General factors and specific processes for interagency consultation,
2. Conflict resolution procedures, and
3. Public consultation procedures developed in accordance with the Metropolitan Planning regulations (23 CFR Part 450, 49 CFR Part 613).

Corridor (analyses): A corridor analysis is used to determine an "optimal corridor" between two points. For environmental purposes the corridor is often a narrow strip of land connecting two larger habitats, and the analyses is done to help conservationists recognize the optimal path between two areas of habitat.

Conservation Area: An area of land that is either being managed, or has a designated protection status, to ensure that natural resources, cultural heritage or biological processes are being preserved. A conservation area may be a nature preserve, a park, a conservation easement, or other area.

Conservation Banking: See mitigation banking.

Conservation Measures: Actions taken or planned to achieve mitigation or conservation objectives.

Conservation and Mitigation Receiving Priority Areas: These are areas identified through advance conservation planning that are important to achieving regional conservation objectives, are currently unprotected and or requiring restoration and, therefore, would be priorities for receiving offsite mitigation funds or actions.

Connectivity (Requirements): Connections between habitat patches that support species viability through a variety of mechanisms such as seasonal migration, seed dispersal, obtaining food or water in different habitats, etc.

Crediting: Providing credit for mitigation or restoration actions usually involving specification of quantities of individual resources (e.g., acres) tied to quantity of impacts needed for projects.

Critical Habitat Designations: The Endangered Species Act (ESA) requires the Federal government to designate "critical habitat" for any species it lists under the ESA. Critical habitat is defined as:

> Specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological resources essential to conservation, and those resources may require special management considerations or protection; and Specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation. (http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm)

Cumulative Effects Assessment: A process used to determine cumulative impact. According to CEQ Sec. 1508.7 "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable

future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Cumulative Impacts: Cumulative impact is the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 CFR § 1508.7)

Current Take: The amount of a resource impacted by current (existing and approved) projects.

D

Data Gaps: Documented gaps in data or information based on a systematic review of data needs and data availability.

Data Security and Use-limitation Agreements: Legal or interagency agreements used to protect species and ecological data from being collected, misused, or misinterpreted.

Data Sources: Agencies, organizations or individuals who are collecting, maintaining, and/or managing data. Authoritative data sources are those recognized to have the best data.

Development: A general term for anthropogenic structures and activities that includes urbanization, industrialization, transportation, mineral extraction, water development, or other human activities that occupy or fragment habitats or that develop renewable or non-renewable resources.

Distribution Maps: Spatial maps that show the distribution of a species or habitats; these maps can be creating using a variety of mapping methods including modeling techniques that utilize species observations and other data, and the use of inductive and/or deductive modeling.

Downscaling: The process of transferring information from a coarser resolution to a finer resolution (e.g., from 15 km pixels to 4 km pixels), commonly conducted when converting global climate model outputs to regional climate change data. Conversely, "upscaling" is the process of transferring information from a finer resolution to a coarser resolution.

E

Ecological: Characterized by the interdependence of living organisms in an environment

Ecology: The scientific study of the relationship between organisms and their environment

Ecosystem Production: the goods and services produced by an ecosystem of value to society

Ecosystem (or ecological) Services: Benefits or 'services' that the natural environment provides to society including ecologically-based outputs such as timber and fish production, filtering excess pollutants, providing a range of nutrients from oxygen to soil and plant-based nutrients, reduce flood hazards, absorb storm surge, and provide unique recreational, scientific, or spiritual opportunities. According to the Millennium Ecological Assessment, there are 4 primary categories of ecosystem services:

- **Provisioning services** are the products obtained from ecosystems, such as food, genetic resources, fiber, and energy.
- **Regulating services** are the benefits obtained from the regulation of ecosystem processes, such as regulation of climate, water, and some human diseases.
- **Cultural services** are the non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experience.
- **Supporting services** are ecosystem services that are necessary for the production of all other ecosystem services. Examples include biomass production, production of atmospheric oxygen, nutrient cycling, water cycling, and provisioning of habitat.

(http://www.ebmtools.org/roadmap/ecosystemservices.html)

Ecological Resources: Resources that come from the natural environment, such as habitats, fish and wildlife, and water

Ecologically Valuable Outputs: Quantifiable ecosystem services considered valuable to society.

Economies of Scale: Reduction in cost per unit resulting from increased production, realized through operational efficiencies. Economies of scale can be accomplished because as production increases, the cost of producing each additional unit falls.

Economic Valuation Studies: Results of studies of the economic value of resources based on the services they provide to society.

Ecosystem Crediting Protocols: Protocols that standardize the operations and management of ecosystem credit creation.

Ecological function and service (also called ecosystem service production function): A description of the relationship between quality-adjusted ecological endpoints and the provision of ecosystem goods and services. This term differs from ecological production function because it includes both the biophysical functions and the non-ecological assessments that are needed to demonstrate a service. Ecological function and service evaluate four things: 1) how ecological endpoints combine with complementary (non-ecological) inputs to generate goods and services; 2) whether the quality of ecological endpoints is sufficient to generate the service; 3) whether required complementary goods and services (trails, roads, homes) are available; and 4) whether demand exists for the service by location. For example, a quantitative or qualitative description of how a population of watchable birds (the ecological endpoint), when combined with complementary inputs such as transportation infrastructure and demand by birders, produces the ecosystem service of recreational bird watching, is an ecosystem service production function. Also see ecological production function. (source: Wainger & Mazzotta 2009, with input from J. Boyd)

Ecological Systems: Are recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding. They are intended to provide a classification unit that is readily mappable, often from remote imagery, and readily identifiable by conservation and resource managers in the field.

Enhancement Areas: Areas that are restored, under mitigation or other projects, in order to create or support habitat that has been identified in the IEF as critical to sustain rare and imperiled species and ecosystems.

Environmental Conservation Strategy: The combination of mapped locations and actions to achieve the conservation objectives for resources.

Environmental Permitting: Federal and state laws require authorization prior to impacting regulated environmental resources. This may include completing consultations or receiving a permit through a regulatory review process with various Federal and State agencies. **Ecological Integrity:** The ability of an ecological system to support and maintain a community of organisms that have the species composition, diversity, and functional organization comparable to those of natural habitats within the ecoregion.

Ecoregion: A geographic area with relative homogeneity in ecosystems. Ecoregions depict areas within which the mosaic of ecosystem components (biotic and abiotic as well as terrestrial and aquatic) differs from those of adjacent regions.

Ecosystem: The interactions of communities of native fish, wildlife, and plants with the abiotic or physical environment.

Ecosystem-Based Approach/Mitigation: A holistic approach to environmental decision-making that takes into account the full array of interactions of the ecosystems and species, as well as anthropogenic activities and influences, present in the area of interest, rather than just the resources in isolation from each other.

Element Occurrence: A term used by Natural Heritage Programs, to generally delineate the location and extent of a species population or ecological community stand, and represents the area of the biological resource that is of conservation or management interest. Element occurrences are documented by voucher specimens (where appropriate) or other forms of observations. A single element occurrence may be documented by multiple specimens or observations taken from different parts of the same population, or from the same population over multiple years.

Environmental Planning: see conservation planning

ESA Section 7: Under section 7(a)(1), of the Endangered Species Act (ESA), federal agencies are directed to implement programs that support the conservation of threatened and endangered species. In section 7(a)(2), the act requires a consultation on Federal actions with the secretary of the interior or commerce, as appropriate. Federally funded programs at the state and local level, including transportation projects, require a consultation process under section 7 of the ESA, which includes a biological assessment. These section 7 consultations are designed to ensure that any action authorized, funded, or carried out is not likely to jeopardize the continued existence of a listed species or destroy or adversely modify critical habitat.

F

Field Validate: Data for a specific species, site or habitat is never 100% complete and current since species and habitats are dynamic and constantly changing, especially in response to human related impacts. The IEF often relies on various ecological resource datasets, and these datasets

are useful when doing regional assessments and planning. But once decisions are made to implement a transportation, infrastructure, or mitigation project, there is often a need to do an on-site visit to validate the current status of an ecological resource that may be impacted. This field validation process can sometimes result in a revision to an assessment and/or planning decision or action.

G

Geographic Information System (GIS): A computer system designed to collect, manage, manipulate, analyze, and display spatially referenced data and associated attributes.

GIS Metadata: A text file describing how a spatial database was created. Metadata files document how the data were created, their content, quality, condition, and other characteristics. Metadata's purpose is to ensure that a user knows the source and quality of the data to help in evaluating of its usefulness, and appropriateness for analyses. The FGDC sets content standards for metadata.

GIS Modeling: The action of generating new information in a geographic information system using existing input data, for example modeling the probable distribution of a species habitat based on information about land cover, soil types, slope, presence of water, etc.

H

Habitat: An ecological or environmental area that is inhabited by a particular species of animal, plant, or other type of organism. It is the natural environment in which an organism lives, or the physical environment that surrounds (influences and is utilized by) a species population. (Living Things: Habitats and Ecosystems". The Franklin Institute. Retrieved 29 June 2011.)

I

Impact Avoidance: To avoid a direct, indirect, and/or cumulative impact to the environment.

Impact Minimization: To minimize a direct, indirect, and/or cumulative impact to the environment.

In-kind: *In-kind* means to replace a lost environmental resource with a resource of similar structural and functional type to the impacted resource. (33 CFR § 332.2)

In-Lieu Fee Mitigation: *In-lieu fee program* means a program involving the restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for DA permits. Similar to a mitigation bank, an in-lieu fee program sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the in-lieu program sponsor. However, the rules governing the operation and use of in-lieu fee programs are somewhat different from the rules governing operation and use of mitigation banks. The operation and use of an in-lieu fee program are governed by an in-lieu fee program instrument. (33 CFR § 332.2)

Indicator: Components of a system whose characteristics (e.g., presence or absence, quantity, distribution) are used as an index of an attribute (e.g., land health) that are too difficult, inconvenient, or expensive to measure.

Infrastructure: The basic facilities needed for the functioning of a community or society, such as transportation and communications systems, utilities, and public institutions, including buildings, roads, utilities, equipment and other structures. In an RVAA, infrastructure can be considered both as a resource to preserve as well as a stressor on ecological and cultural resources.

Integrated Ecological Framework or IEF: The IEF is a technical guide that supports transportation planners and natural resource specialists use of a standardized, science-based approach to the identification of ecological priorities and the integration of those into transportation and infrastructure decision making - as outlined in *Eco-Logical*.

Integrated Planning: When multiple agencies and partners combine planning efforts in order to understand where their work intersects and how best to leverage resources toward shared goals and priorities.

K

Known Species Locations: An accurately mapped location of a species who's location and (sometimes) condition has been verified "in the field" by a qualified field biologist, for example Element Occurrences (EOs) that are collected by NatureServe member programs or natural heritage programs use a standard methodology for data collection, mapping, and assessment, and an EO is defined as an area of land and/or water in which an element (such as a species or ecological unit) is or was present as demonstrated by verifiable sources of evidence.

L

Land Cover Data: Land cover is the (bio)physical material or cover on the surface of the earth. There are two primary methods for capturing information or data on land cover: field survey and analysis of remotely sensed imagery. Often surveys of land cover define similarly named categories of land cover (e.g., forests) in different ways. In the U.S. the U.S. Geological Survey (USGS), National Center for Earth Resources Observation and Science (EROS) is the primary developer of land cover data as part of the USGS Land Cover Characterization Program (LCCP).

Long Range Transportation Plan: A document resulting from regional or statewide collaboration and consensus on a region or state's transportation system, and serving as the defining vision for the region's or state's transportation systems and services. In metropolitan areas, the plan indicates all of the transportation improvements scheduled for funding over the next 20 years. (http://www.fhwa.dot.gov/planning/glossary/glossary_listing.cfm?sort=definition&TitleStart=L)

Land Use and Management Planning: are terms used for a branch of public policy encompassing various disciplines which seek to order and regulate land use and planning to prevent land-use conflicts. Governments use land-use planning to manage the development of land within their jurisdictions. In doing so, the governmental unit can plan for the needs of the community while safeguarding natural resources. To this end, it is the systematic assessment of land and water

potential, alternatives for land use, and economic and social conditions in order to select and adopt the best land-use options. Often one element of a comprehensive plan, a land-use plan provides a vision for the future possibilities of development in neighborhoods, districts, cities, or any defined planning area. (Canadian Institute of Planners, 2011, Wikepedia, 2013)

M

Minimum Viable Habitat Size: Minimum viable habitat size is usually estimated as the habitat size necessary to ensure the survival of the species and habitat into the future. The minimum viable habitat size is determined using analyses involving species and habitat experts, data, and sometimes modeling.

Mitigation: The CEQ regulations (http://environment.fhwa.dot.gov/projdev/tdmmitig2.asp) define mitigation as:

- Avoiding the impact altogether by not taking a certain action or parts of an action.
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- Compensating for the impact by replacing or providing substitute resources or environments

Mitigation (or Conservation) Banking: *Mitigation bank* means a site, or suite of sites, where resources (e.g., wetlands, streams, riparian areas) are restored, established, enhanced, and/or preserved for the purpose of providing compensatory mitigation for impacts authorized by DA permits. In general, a mitigation bank sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor. The operation and use of a mitigation bank are governed by a mitigation banking instrument. (33 CFR § 332.2)

Model/Modeling: Any representation, whether verbal, diagrammatic, or mathematical, of an object or phenomenon. Natural resource models typically characterize resource systems in terms of their status and change through time. Models incorporate hypotheses about resource structures and functions, and they generate predictions about the effects of management actions.

N

Natural Resources: Natural resources can be defined in many ways, but in the context of this report natural resources refer to resources that naturally occur in the environment such as land, water, air, soil, plants, animals, etc.

Natural Resource Planning (*see Conservation Planning*)

Natural heritage Program: An agency or organization, usually based within a state or provincial natural resource agency, whose mission is to collect, document, and analyze data on the location and condition of biological and other natural resources (such as geologic or aquatic resources) of

the jurisdiction. These programs typically have particular responsibility for documenting at-risk species and threatened ecosystems, and as members of NatureServe all use consistent standards for collecting and managing this data allowing information from different programs to be shared and combined regionally, nationally, and internationally. The staff from across the network are experts in their fields, and include some of the most knowledgeable field biologists and conservation planners in their regions. Together the NatureServe network collects and analyzes data about the plants, animals, and ecological communities of the Western Hemisphere. There are 82 member organizations, known as natural heritage programs or conservation data centers (CDCs), and they operate throughout the United States, Canada, and Latin America and the Caribbean. (See *www.natureserve.org/visitLocal/index.jsp* for additional information.)

O

On-ramp: There are several places in the IEF where a practitioner can begin to utilize the steps and substeps, thus we use the term "on-ramp" to describe a starting point for using the IEF.

Off-site Compensation: "Off-site" is a specific term referring to implementation of mitigation at a location not on or immediately adjacent to the site of impacts, but within the same watershed.

Out-of-kind Mitigation: A mitigation project that replaces lost resources with resources that are not similar (e.g., restoring a different type of wetland than the one that was impacted). The mitigation project may or may not be in close proximity to the site of impact.

P

Performance Measures: These are measures that address two IEF components. First are performance measures for projects which describe the planned and acceptable impacts to resources, and project guidelines to minimize impacts. Second are performance measures for mitigation actions which can include resources types, resource area, and other measures of resource viability that must be achieved for successful mitigation.

Predicted Species Locations: see predictive species modeling

Predictive Species Modeling (or Predictive Models of Priority Resources): Predictive distribution modeling is an innovative GIS-based method used to produce predictive maps of where elements (i.e., species, ecological community type) are likely to occur and likely not to occur.

Preferred Alternatives: Under SAFETEA-LU's environmental review process for transportation projects there are a set of requirements that include the analysis of (route) alternatives; and the identification and design of the preferred alternative (route). The goal of the IEF is to provide guidance and analyses that will help transportation and natural resource agencies work together to select the preferred alternative from a comprehensive evaluation of all alternatives that will minimize the environmental impacts while still meeting transportation goals.

Programmatic ESA Section 7 Consultation: see programmatic implementation and agreements

Programmatic Implementation and Agreements: A programmatic agreement has terms of a formal, legally binding agreement between a state Department of Transportation and other federal and state regulatory agencies, which establish a process for consultation and project review usually based on a set of agreed upon actions. The main objective of taking a programmatic approach to

consultation is to addresses the effects upon listed species resulting from the implementation of a suite of actions as a whole and provide a strategy, or process, for ESA compliance on the individual activities.

Protected Lands (Protected Area): A geographical space designated, through legal or other means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." IUCN

Q

Quantitative Assessment: A process that measures the probability and consequences of risks and estimates their implications for project objectives.

R

Regional Ecological Framework or REF: As defined in *Eco-Logical*, an element of integrated planning that likely consists of an overlay of maps of [natural resource] agencies [and/or environmental organizations] individual plans, accompanied by descriptions of conservation goals in the defined region.

Regional Ecological and Infrastructure Development Framework or REIDF: The actionable plan needed to implement ecological and infrastructure projects that minimizes environmental impacts, increases opportunities for environmental restoration and conservation, and supports effective and efficient implementation of transportation plans. This actionable plan is created by overlaying the REF with transportation plans and scenarios, doing an assessment on the impact each has on the other, and making adjustments to achieve the best balance of environmental and transportation outcomes.

Regional General Permit (RGPs): CWA Section 404 establishes a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. Responsibility for administering and enforcing Section 404 is shared by the U.S. Army Corps of Engineers (USACE) and EPA. Under Section 404(e) of the CWA, general permits may be issued by USACE for categories of activities that are similar in nature and would have only minimal individual or cumulative adverse impacts to aquatic resources. General permits can be issued on a nationwide ("nationwide permit") or regional ("regional general permit") basis. A general permit can also be issued on a programmatic basis ("programmatic general permit") to avoid duplication of permits for state, local or other Federal agency programs.

Regional Mitigation Strategies: These are strategies intended to define mitigation needs for a particular scenario that incorporate all significant, foreseeable stressors and their impacts on resources.

Regional-scale or Context: referring to assessment and planning conducted within an area characterized by multi-jurisdiction and or ecological or watershed boundaries. There is no set size that defines a region but it is larger than a local planning jurisdiction and may range from a Metropolitan Planning Organization boundary or larger.

Regulatory Assurance: Acceptance from regulatory agencies of planned actions to mitigate identified impacts.

Resource Requirements: (*see Resource Conservation Requirements*)

Resource Conservation Requirements: Define what resources need to remain viable such as minimum patch/occurrence sizes, sensitivity/compatibility with stressors, minimum population sizes, etc.

Restoration: Re-establishment of wetland and/or other aquatic resource characteristics and function(s) at a site where they have ceased to exist, or exist in a substantially degraded state. (http://www.wetlands.com/pro/fr21jul99pte.htm)

Restoration Areas: Locations identified to conduct restoration activities for target resources

Right-of-way: A parcel of land granted by deed or easement for construction and maintenance according to a designated use. This may include highways, streets, canals, ditches, etc. and the areas adjacent to these structures.

S

Scenario-based Planning: An approach for developing plausible descriptions and optionally maps of future conditions incorporating changes in stressors and new stressors (see for example).

Scenarios: Specific to the IEF, scenarios are maps that incorporate land use (including conservation), infrastructure, and all other stressors for particular time frames identified for assessment.

Scientifically-based Methods: Methods that employ one or more of the following: 1) a systematic approach to observation or analyses, 2) use of best available data, 3) use of rigorous data analyses that are adequate to test the stated hypotheses, 4) measurements or observational methods that provide valid data across multiple evaluators and observers, and across multiple measurements and observations, and 5) are accepted by a peer-reviewed journal or approved by a panel of independent experts through a comparatively rigorous, objective, and scientific review.

Spatial Data: Information about the location and shape of, and relationships among, geographic features, usually stored as coordinates and topology within a geographic information system

Species and Habitat Recovery: Refers to process that Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) require of creating an Endangered Species Recovery Plan outlining the goals, tasks required, likely costs, and estimated timeline to recover endangered species (i.e., increase their numbers and improve their management to the point where they can be removed from the endangered list).

Species of Conservation Concern: Any species that are 'of concern' because they are vulnerable to extinction due to habitat destruction or other impact that has led to the decline of viable populations of this species , or are vulnerable because they inherently have a very limited range of occurrence and therefore are more vulnerable to potential impacts. These species may or may not have a legal protection status.

Species Locations: (*see Known Species Locations*)

Species Observations: The documentation of evidence of the presence or absence of an Element at a specified location. Observations document the location of the Element, and may include non-spatial information such as abundance, distribution, reproductive status or phenology, ecological associations, and environmental conditions.

Species Viability: Species are viable if they have the conditions to persist over time.

Stakeholders: An individual or group with an interest in the success of an organization in delivering intended results and maintaining the viability of the organization's products and services. Stakeholders influence programs, products, and services.

State Wildlife Action Plan: Under the Wildlife Conservation and Restoration Program and the State Wildlife Grants Program, Congress charged each state and territory with developing a wildlife action plan. These proactive plans, known technically as "comprehensive wildlife conservation strategies," assess the health of each state's wildlife and habitats, identify the problems they face, and outline the actions that are needed to conserve them over the long term. (http://teaming.com/state-wildlife-action-plans-swaps)

Strategic Habitat Conservation : Strategic habitat conservation (SHC) is a science-based framework for making management decisions about where and how to deliver conservation efficiently to achieve specific biological outcomes. Strategic habitat conservation incorporates biological planning, conservation design, delivery, monitoring and research in a framework that allows change (adaptive) and repetition (iterative). (http://training.fws.gov/BART/resources/SHC/SHC_fact_sheet.htm)

Streamline/Streamlining: The process of several agencies working together to establish realistic time frames, adhering to those time frames, and effectively coordinating time and resources in order to complete a transportation process as efficiently but quickly as possible. Section 1309 of the Transportation Equity Act for the 21st Century (TEA-21) mandated environmental streamlining as the timely delivery of transportation projects while protecting and enhancing the environment. A key element of environmental streamlining is communication with and gathering of input from the public and stakeholders. (http://www.transportationforcommunities.com/shrpc01/glossary)

Stressor: Any feature, action, or phenomena capable of negatively affecting a resource. Factors causing such impacts may or may not have anthropogenic origins. (Note that a stressor for one resource may not be a stressor on another.)

Systematic Conservation Planning: An approach to assessing and planning for conservation that is based on certain concepts such as coarse and fine filters for selecting surrogates for biodiversity and establishing quantitative goals for representing biodiversity in a region (see Groves 2003)

T

Target Resources: Resources that are the objective of particular actions in a plan or location. For example, the resources requiring mitigation under a particular plan or for a particular location to receive mitigation action.

Transaction Costs: The cost associated with exchange of goods or services. Transaction costs cover a wide range but in the context of transportation and natural resources planning and

management some of these costs include: cost of communication and consultation, fees and costs associated with creating easements, costs associated with obtaining data and conducting analyses, biological inventories of species and habitats, etc.

Transportation and Natural Resource Practitioner: Staff from any local, regional, state or other type of planning agency or organization.

Transportation Improvement Program (TIP): A document prepared by a metropolitan planning organization that lists projects to be funded with FHWA/FTA funds for the next one- to three-year period. (http://www.fhwa.dot.gov/planning/glossary/glossary_listing.cfm?sort=definition&TitleStart=L)

Transportation Planner: Staff leading or involved in transportation planning activities at a state Department of Transportation (DOT), Metropolitan Planning Organization (MPO), and local county or tribal planning agencies. Under the Eco-Logical guidance the goal is to create a regional-scale approach to planning which involves local, regional, and state level agencies and organizations working collaboratively.

Transportation Planning: In the U.S. transportation planning includes public involvement and considers land use, development, safety and security. The planning process includes an analysis and evaluation of the potential impact of transportation plans and projects, and strives to address the wide range of societal needs and concerns. Planning is done at the local, rural, tribal, metropolitan, statewide, national, and international level.

Transportation Project Development (and Delivery): Transportation project development is the general process of seeing a transportation project from the beginning, where a need is identified from an existing plan, to getting it programmed, to the end, where it is approved for implementation. Then the delivery of a transportation project is the process of implementing it once it is developed.

U

Unfragmented Habitat Patches: Fragmented habitat has discontinuities or disturbances in an organism's preferred environment. Fragmentation of habitats can cause the fragmentation of and impact to specific species populations. Unfragmented habitat patches are areas of land that have no discontinuities or barriers. Species typically have a minimum habitat size that is required for their survival, and in some cases this habitat needs to be unfragmented or have limited fragmentation for the species to be viable (persist over time).

V

Vulnerability: By coupling the exposure of resources to stressors with the assessment of resource responses to stressors, the effect of stressors on the resources (i.e., their vulnerability) results can be calculated.

Vegetation Data: Data describing vegetation and plant communities composition and distribution.

W

Watershed: *Watershed* means a land area that drains to a common waterway, such as a stream, lake, estuary, wetland, or ultimately the ocean. (33 CFR § 332.2)

Watershed Restoration: Restoration is … *the return of an ecosystem to a close approximation of its condition prior to disturbance. In restoration, ecological damage to the resource is repaired. Both the structure and the functions of the ecosystem are recreated … The goal is to emulate a natural, functioning, self-regulating system that is integrated with the ecological landscape in which it occurs.* (NRC 1992)

Weighting Values: These values are typically expressed as numeric scores on a fixed scale to indicate the relative importance of individual resources within the Regional Ecological Framework. They can be used to calculate and depict the relative importance or value of locations based on the weights of the resources present.

Wetland Function: Wetland functions are defined as a process or series of processes that take place within a wetland. These include the storage of water, transformation of nutrients, growth of living matter, and diversity of wetland plants, and they have value for the wetland itself, for surrounding ecosystems, and for people. Functions can be grouped broadly as habitat, hydrologic, or water quality, although these distinctions are somewhat arbitrary and simplistic. For example, the value of a wetland for recreation (hunting, fishing, bird watching) is a product of all the processes that work together to create and maintain the wetland. (http://water.usgs.gov/nwsum/WSP2425/functions.html)

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Appendix A: Detailed Updates to IEF

Documented below are all substantive changes that were made from the original IEF Guide. Any IEF steps or substeps that are not included below did not have substantive changes. Minor edits made for clarity are not documented below.

Step 2

Step 2 Original Title: Characterize Resource Status, Integrate Conservation, Natural Resource, Watershed and Species Recovery and State Wildlife Action Plans

> **Step 2 Updated Title:** Create the Regional Ecological Framework
>
> **Step 2 Summary of Changes:** The most significant updates to the IEF start in Step 2, and include updates to Step 3 and 4. These updates address confusion about the order of the IEF process, and how each step is described. The original Step 2 was the creation of an ecological conservation strategy resulting from combining all conservation plans, data, and getting appropriate experts and specialists to agree on environmental conservation priorities and goals. In the updated IEF Manager's Guide, Step 2 is the same process of creating an environmental conservation strategy but the resulting product has been re-characterized as the Regional Ecological Framework (REF) which initially was the product resulting from the original Step 3 that included an overlay of the conservation strategy with the transportation plans and data. The C06 project team determined that it was useful to have a title for the environmental conservation related product that resulted from the step 2 process, and that the REF title more accurately described this ecologically focused product. In addition, minor changes were made to substeps 2e, 2f, and 2g (outlined below).

Changes to Substeps

Original substep 2e: Produce geospatial overlays of data and plans outlined above, as well as supporting priorities, to guide the development of an overall conservation strategy for the planning region that identifies conservation priorities and opportunities, and evaluates stressors and opportunities for mitigation and restoration.

> **Updated substep 2e:** Delineate priority areas for conservation and mitigation, if these do not already exist. These should include all of the identified resources and follow principles from systematic conservation planning and should include opportunities for off-site mitigation through restoring habitat.
>
> **Summary of substep 2e updates:** Although the product of substep 2e is the same – priority conservation and mitigation areas – this substep was updated to more accurately described the necessary process of delineating these areas based on a systematic

conservation planning process involving conservation expertise rather than just an 'overlay' of data and plans.

Original substep 2f: Convene a team of stakeholders to review the geospatial overlay and associated goals/priorities, and identify actions to support them.

Updated substep 2f: Convene a team of stakeholders to review the draft REF generated from the above steps. Identify any issues that need correction and finalize the REF.

This step was refocused from reviewing an overlay and identifying actions to support priorities identified to reviewing the REF to identify an issues that need to be addressed in order for all the stakeholders to finalize it.

Summary of substep 2f updates: The original version included the identification of actions but since the integration of information about potential impacts (Step 4) is critical to complete before appropriate actions are identified, this part of the step was modified. Thus this step became focused on only reviewing and finalizing the REF with input from stakeholders.

Original substep 2g: Record methods, concurrence and rationales of this step based on stakeholder input (e.g., how the identified areas address the conservation/preservation, or restoration needs and goals identified for the area).

Updated substep 2g: Document the REF objectives, decisions, and methods based on stakeholder input, and the technical and scientific methods used in steps 2a-2f above. This documentation should occur in forms suitable for GIS metadata, formal reporting, and outreach to support use, updating, and external products.

Summary of 2g substep updates: Mostly the wording was clarified in this substep but we also were more explicit in our recommendations about how to document decisions.

Step 3

Step 3 Original Title: Create Regional Ecosystem Framework (Conservation Strategy + Transportation Plan)

Step 3 Updated Title: Define Transportation and Infrastructure Scenarios for Assessment

Step 3 Summary of Changes: Originally, Step 3 was an overlay of the integrated conservation strategy and transportation plan, but input we received was that this was confusing since there is a separate process that needs to be led by transportation practitioners to integrate transportation and infrastructure plans and data in order to determine the transportation needs, goals and priorities. This same concept applies to Step 2, since creating the REF is typically done separately by environmental, conservation and natural resource stakeholders from varies organizations and agencies. Where the infrastructure and environmental stakeholders typically begin to work together is during the process of developing a regional vision (Step 1), and then again when the overlay and integration of the REF with the transportation and other infrastructure plans,

information, and scenarios happens (updated Step 4). This does not mean that stakeholders involved in the transportation/infrastructure side of things and the stakeholders involved in the environmental side of things will not have any communication during Step 2 and Step 3, but the majority of the discussion will happen during Step 1 and then again in Step 4 during the development and review of the REDIF.

Changes to Substeps

Summary of all substep changes listed below: All of the changes to the substeps below support the fundamental change to this step from the focus on the integration of transportation and environmental strategies to the integration of just the transportation related data, plans, priorities, and goals, and the creation of transportation scenarios that can then be overlaid with the REF in Step 4 to determine impacts.

Original substep 3a: Overlay the geospatially mapped Long Range Transportation Plan (or TIP/STIP) with conservation priorities and other land uses

> **Update substep 3a:** Convene stakeholders and identify appropriate scenarios to represent. Formal scenario-based planning approaches can be very useful for envisioning, describing, and prioritizing scenarios. This step should include what time frames to represent (e.g., current, 15 years, 50 years), the scope of information included in the scenarios (i.e., just transportation or in combination with all relevant uses, stressors, and activities), and what future assumptions to incorporate and represent in alternate scenarios (e.g., low versus high growth, climate changes, transportation funding, etc.).

Original substep 3b: Identify and show 1) areas and resources potentially impacted by transportation projects and 2) potential opportunities for joint action on conservation or restoration priorities that could count for 404 and Section 7 regulatory requirements.

> **Updated substep 3b:** Obtain data to represent the land uses, activities, and other stressors for each scenario. Specific to transportation, include the Long Range Transportation Plan (or TIP/STIP) and preferably the full set of land use and management plans from the major local, state, and federal regulatory, land management and planning agencies in the region.

Original substep 3c: Identify the high-level conservation goals and priorities, and opportunities for achieving them, relative to the transportation plan and other land uses/plans.

> **Updated substep 3c:** Assemble the draft scenarios and review with the stakeholders. Note and make corrections as needed.

Original substep 3d: Review and verify REF with stakeholders.

> **Updated substep 3d:** Provide the scenario to the stakeholders.

Step 4

Step 4 Original Title: Assess land use & transportation effects on resource conservation objectives identified in the REF

> **Step 4 Updated Title:** Create an Ecosystem and Infrastructure Development Framework (REIDF)
>
> **Step 4 Summary of Changes:** Although the focus and products of the original step 4 is the same – an assessment of the effects of land use & transportation effects on resource conservation objectives - the title and sub-steps were changed for clarity. Originally the product resulting from the analyses in step 4 was called the Regional Ecological Framework, but the team felt that this title did not adequately characterize the fact that it included an analyses of the impacts of transportation and other infrastructure on environmental resources. So the title of the step was changed, and several changes were made to the substeps (documented below). In addition, some processes included in the substeps were combined resulting in the elimination of the last two steps included in the original IEF Guide.

Changes to Substeps

Original substep 4b: Identify/rate how priority conservation areas and individual resources respond to different land uses and types of transportation improvements.

> **Updated substep 4b:** Establish individual resource conservation requirements (e.g., minimum viable habitat sizes, connectivity requirements, etc.) and their response to different types of transportation improvements (and other stressors).
>
> **Summary of substep 4b changes:** Added process of establishing resource conservation requirements before rating their response to different stressors.

Original substep 4c: Develop programmatic cumulative effects assessment scenarios that combine transportation plan scenarios with existing development and disturbances, other impacting stressors, and existing secured conservation areas. Include climate change threats to better understand what resources/areas may no longer be viable or what new resources may become conservation priorities in the planning region during the planning horizon.

> **Updated substep 4c:** Create the REIDF by combining the REF (from step 2) with the scenarios from step 3 to identify which priority areas or resources would be affected, to identify the nature of the effect (e.g., negative, neutral, beneficial) and to quantify the effect noting the level of precision of mapping inputs. An initial visual overlay of the scenarios with the REF can point to particular problem areas while a quantitative assessment of cumulative effects facilitates better comparison among scenarios and quantifies needs for mitigation.
>
> **Summary of substep 4c changes:** No significant changes in content of step, but reworded to be clearer and added the suggestion of including a climate change threat assessment.

Original substep 4d: Intersect the REF with one or more cumulative effects assessment scenarios to identify which priority areas and/or resources would be affected, to identify the nature of the

effect (e.g., negative, neutral, beneficial) and to quantify the effect, noting the level of precision based on the precision of the map inputs.

> **Updated substep 4d:** Compare scenarios, and select the one that optimizes transportation/infrastructure objectives AND minimizes adverse environmental impacts (the least damaging scenario) or use the results to create a new scenario.
>
> **Summary of substep 4d changes:** Originally this step included intersecting the REF with the cumulative effects assessment scenarios but those analyses are outlined in substep 4c so this step is focused on the process of comparing the results of the various scenarios (created in substep 4c), and selecting the one with the best overall conservation results and minimal impacts.

Original substep 4e: Compare plan scenarios, and select the one that optimizes transportation objectives AND minimizes adverse environmental impacts (the least environmentally damaging practicable scenario).

> **Updated substep 4e:** Identify mitigation needs for impacts that are unavoidable and/or that may require minimization through project design/implementation/maintenance, and that may require offsite mitigation. For impacts that do not appear practicable to mitigate in kind, review with appropriate resource agency partners the desirability of mitigating out-of-kind (e.g., by helping secure a very high priority conservation area supporting other resource objectives).
>
> **Summary of 4e changes:** The comparison and selection of scenarios is outlined in substep 4d, so the focus of this step is the process of identifying mitigation needs based on knowing what the impacts will be of the selected scenario.

Original substep 4f: Identify mitigation needs for impacts that are unavoidable and that may require minimization through project design/implementation/maintenance, and that may require off-site mitigation. For impacts that do not appear practicable to mitigate in-kind, review with appropriate resource agency partners the desirability of mitigating out-of-kind (e.g., by helping secure a very high priority conservation area supporting other resource objectives).

> **Updated substep 4f:** Deleted
>
> **Summary of 4f substep changes:** All processes related to identifying mitigation needs were integrated into the updated substep 4e so the original substep 4f was deleted.

Original Step 4g: Establish the preferred transportation plan, and quantify mitigation needs including the amount and quality of area by resource type for which impacts could not be avoided and require further mitigation attention.

> **Updated substep 4g:** Deleted
>
> **Summary of substep 4g changes:** All processes related to identifying mitigation needs were integrated into the updated substep 4e so the original substep 4g was deleted.

Step 5

Step 5 Original Title: Establish and Prioritize Ecological Actions, Restoration and Conservation Sites (*no change*)

> **Step 5 Summary of Changes:** This step remained the same in terms of the title, processes, and products. One of the substeps was eliminated because it was redundant of other substeps, more detail on mitigation related processes were provided for substeps 5b & 5d, and all other changes were minor and not substantive but merely added clarity.

Changes to Substeps

Original substep 5b: Select potential mitigation areas according to the ranking protocols described above.

> **Updated substep 5b:** Select potential mitigation areas according to the ranking protocols described above. Create a new scenario (repeat step 3) specifying the mitigation actions for selected sites and re-evaluate the mitigation scenario (repeat step 4) to validate that the expected mitigation benefits can be achieved. The development of a comprehensive REF in collaboration with regulatory agencies should expedite this step since the priority mitigation areas would already be approved by these agencies reducing the time it takes to select and move forward on mitigation efforts that are more likely to contribute to high priority conservation needs.
>
> **Summary of substep 5b changes:** Added more detail about how to select a potential mitigation areas and associated actions, as well as information on how to get regulatory assurances associated with these sites and actions.

Original substep 5d: Develop/refine a regional conservation and mitigation strategy (set of preferred actions) to achieve eco-regional conservation/restoration goals and advance infrastructure projects

> **Updated substep 5d:** Develop/refine a regional conservation and mitigation plan and strategy to achieve ecoregional conservation/restoration goals and advance infrastructure projects. This should address timing of actions related to when impacts are expected to occur and the urgency to secure mitigation sites before they are developed or used for other mitigation actions.
>
> **Summary of substep 5d changes:** Added sentence to emphasize importance of addressing the 'timing' of actions as they related to impacts.

Original substep 5e: Decide on and create a map of areas to conserve, manage, protect, or restore, including documentation of the resources and their quantities to be retained/restored in each area, and the agency and mechanisms for conducting the mitigation.

> **Updated substep 5e:** Obtain agreement on actions from stakeholders to implement the mitigation.
>
> **Summary of substep 5e changes:** Substeps b, c & d are all processes that support and include the creation of areas that can potentially contribute to mitigation goals so the

original substep 5e was redundant. Thus we deleted the original substep 5e and therefore substep 5f became 5e.

Original substep 5f: Obtain agreement on ecological actions from stakeholders.

Summary of substep 5f changes: Deleted because substep 5e in the original REF was deleted, and thus this step became substep 5e. See reason for deletion of substep 5e above.

Step 6

Step 6 Original Title: Develop Crediting Strategy (*no change*)

Step 6 Summary of Changes: The title, focus, and approach of this step remain the same as in the original IEF Guide, but a more detailed summary of each substep was provided, and one significant concept was added to substep 6b (see below).

Changes to Substeps

Original substep 6b: Evaluate ecosystem and landscape needs and context to identify measurement options

Updated substep 6b: Identify Ecosystem Crediting Platforms or Protocols developed within the region, and evaluate their applicability to resources identified as priority within the REF.

Summary of substep 6b changes: Originally the step was worded to 'evaluate ecosystem and landscape needs and context to identify measurement options'. But the updated version describes the use of platforms and protocols either already developed or adopted from another region.

Step 7:

Step 7 Original Title: Develop Programmatic Consultation, Biological Opinion or Permit (*no change*)

Step 7 Summary of Changes: A few minor editorial changes were made to Step 7 to add clarity, but summarized below is one substantive change to substep 7a that led to the addition of a new step (7e).

Changes to Substeps

Original substep 7a: Ensure agreements are documented relating to CWA Section 404 permitting, avoidance and minimization, ESA Section 7 consultation, roles and responsibilities, land ownership and management, conservation measures, etc.

Updated substep 7a. Identify actions that could be taken to programmatically benefit regulated resources and ensure agreements are documented relating to CWA Section 404

permitting, avoidance and minimization, ESA Section 7 consultation, roles and responsibilities, land ownership and management, conservation measures, etc.

Summary of substep 7a changes: Change keeps focus on first identifying actions that support a programmatic approach to working on regulatory processes, rather than focusing on the development of agreements upfront. Once actions are identified in 7a, then substeps 7b, 7c, and 7d continue to focus on actions that support a programmatic approach.

New substep 7e: Develop programmatic ESA Section 7 consultation, Special Area Management Plan (SAMP), Section 404 Regional General Permits (RGPs), or other programmatic agreements to advance conservation action in line with CWA Section 404 and ESA program objectives/requirements and with maximum assurance that conservation/restoration investments by DOTs count or will count.

Due to the addition of substep 7e, the substep that was formally 7e. becomes 7f. Other than placement there were no changes to this substep.

Summary of addition of substep 7f: The change in substep 7a, then led to the need for a new substep (7e) that focuses on the development of programmatic agreements to codify the procedures and actions identified in substeps 7a-d. Formal programmatic agreements can easily include the type of technical approaches that are introduced in the IEF steps 2-6 thereby institutionalizing a regional, multi-stakeholder, and multi-resource approach to planning, and project development.

Step 8

Step 8 Original Title: Implement Agreements and Adaptive Management

Step 8 Updated Title: Deliver Conservation and Transportation Projects

Step 8 Summary of Changes: Change to title to better summarize the focus of the substeps - to deliver or implement conservation and transportation projects based on the outcomes and information from all the previous steps and substeps. No substantive changes to any of the substeps.

Step 9

Step 9 Original Title: Update the Regional Ecosystem Framework

Step 9 Updated Title: Update Regional Ecosystem Framework, Scenarios, and Regional Assessment

Step 9 Summary of Changes: Change to title to emphasize that updates should be happening to the conservation data included in the REF as well as updates to the scenarios which are analyses based on overlays of the most current REF as well as the most updated

transportation and other infrastructure data and impacts information in order to conduct accurate regional assessments on an ongoing basis. Documented below are substantive changes that were made to two substeps.

Changes to Substeps

Original substep 9b: Update the area/resource conservation requirements, responses, and indicators in collaboration with stakeholders (e.g., assess regional goals, update to minimum required area for species and/or habitat, review confidence threshold for achieving goals, review weighting values of resources in REF, evaluate responses to land use and infrastructure).

Updated substep 9b: Update the conservation area/resource requirements, responses, and indicators in response to new research and data, and results of management actions and performance measures (e.g., assess regional goals, update to minimum required area for species and/or habitat, review weighting values of resources in REF, and evaluate responses to stressors).

Summary of substep 9b changes: This substep was changed to focus on environmental conservation updates only, and in addition the phrase "in collaboration with stakeholders" was taken out since this substep would likely not include all IEF stakeholders but instead include stakeholders and others directly involved in developing conservation and natural resource data, goals and plans.

Original substep 9c: Update the implementation status of areas in the REF to review those areas that are contributing to REF goals and priorities, and determine if additional conservation/protection action is required.

Updated substep 9c: Update the implementation and performance status of mitigation areas (conservation/restoration investments that have occurred) in the REF to evaluate whether those areas are contributing to REF goals and priorities. This will identify whether a mitigation area should be re-categorized as an established conservation area for specific resources or if it is still available for future mitigation action.

Summary of substep 9c changes: Changes made to clarify that the focus should be on mitigation areas. In addition, changes made emphasized that not only the implementation status of mitigation should be evaluated, but also whether established mitigation areas are meeting the conservation performance goals that were developed in the REF. Lastly, an addition was made to ensure that all mitigation areas are re-categorized so that if further action is needed to meet REF goals that would be documented for future assessments.