<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRITE: Border Region Information on Transportation and the Environment, Jocelyn DeHaas and Mary E. White</td>
<td>159</td>
</tr>
<tr>
<td>Endangered Species Protection and Section 7 Coordination: Building Consensus Among Agencies and the Public, William Branch, James Howard, and Scott Smith</td>
<td>180</td>
</tr>
<tr>
<td>Enhancing Protection for Unusually Sensitive Ecological Areas from Pipeline Releases, Dennis Fink and Christina Sames</td>
<td>182</td>
</tr>
<tr>
<td>Environmental Streamlining of the NEPA Process, Laura Dawood and Lori Kennedy</td>
<td>284A</td>
</tr>
<tr>
<td>Identification and Management of Linkage Zones for Grizzly Bears Between the Large Blocks of Public Land in the Northern Rocky Mountains, Christopher Servheen, John Waller, and Per Sandstrom</td>
<td>161</td>
</tr>
<tr>
<td>Innovative Implementation of the Endangered Species Act to Improve Wildlife Passage, Dan Davis and Mary Gray</td>
<td>199</td>
</tr>
<tr>
<td>Long-Range Multi-Species Advance Mitigation: CDOT's Shortgrass Prairie Initiative Process and Benefits, Marie Venner</td>
<td>200</td>
</tr>
<tr>
<td>Nature of Roads, Induced Growth, and the Endangered Species Act: A Practical Approach for Addressing the Indirect Effects of Transportation Projects in ESA Consultations, Paul Wagner and Leni Oman</td>
<td>207</td>
</tr>
<tr>
<td>NEPA and Transportation: Need and Strategies for Early Involvement, Elaine Somers</td>
<td>208</td>
</tr>
<tr>
<td>NEPA/404 Integrated Process: A Case Study, Mary Dircks Frazier</td>
<td>220</td>
</tr>
<tr>
<td>Pennsylvania Corridor O: A Model for Interactive Design, Berton Kisner and Katherine Farrow</td>
<td>231</td>
</tr>
<tr>
<td>Preserving a Spirit of Place: U.S. Highway 93 on the Flathead Indian Reservation, Joel Marshik, Lyle P. Renz, James L. Sipes, Dale Becker and Dale Paulson</td>
<td>244</td>
</tr>
<tr>
<td>Proactive, State-Based, Incentive-Driven Policy for Habitat Conservation, Mark Shaffer, Sara Vickerman, Frank Casey, Robert Dewey, Laura Watchman, William Snipell, Michael Senatone, and Robert Ferris</td>
<td>257</td>
</tr>
<tr>
<td>Promoting Environmental Stewardship in New York State Department of Transportation, Debra Nelson, Gary McVoy, Laura Greninger, and Kurt Weiskotten</td>
<td>264</td>
</tr>
<tr>
<td>Reinventing How WSDOT Carries Out the Reinvention of the National Environmental Policy Act, Sandra Manning and Doug Pineo</td>
<td>269</td>
</tr>
<tr>
<td>State of Washington Joint Aquatic Resources Permit Application (JARPA), Sandra Manning and Doug Pineo</td>
<td>271</td>
</tr>
<tr>
<td>Washington State Department of Transportation Contaminated Sites and Endangered Species Act Risk Reduction, Melany Vorass and Gerald Portele</td>
<td>272</td>
</tr>
<tr>
<td>Washington State Department of Transportation’s Proactive Approach to Imminent Listings Under the ESA, Marion Carey and Bill Leonard</td>
<td>278</td>
</tr>
</tbody>
</table>
Abstract
Knowledge and information are critical components of planning and community decision-making. A key challenge to addressing transportation-related environmental concerns is obtaining enough information to make sound policy decisions. To meet this challenge, ATRI has established a repository for Border Region Information on Transportation and the Environment (BRITE).

The BRITE is a comprehensive online and text-based annotated bibliography that provides full bibliographic information and contact sources for pertinent social and natural science research projects. We believe that the BRITE is the first repository of its kind. Such information sharing as is provided by the BRITE can enable precious research dollars to go farther because researchers can avoid the duplication of efforts. It also can allow NGOs and the general public to quickly and easily locate information that may be relevant to local planning and policy efforts. In doing so, the BRITE can create circumstances which will generate collaborative efforts among diverse entities.

In 1983, the US and Mexico signed the “La Paz Agreement” which defined the border zone as the region situated 60 miles (100 kilometers) on either side of the 2,000-mile international boundary between the US and Mexico. The BRITE also uses this definition. The region encompasses approximately 240,000 square miles of diverse ecological territory that include wetlands, semi-arid, desert, and coastal regions. In this desert environment, transportation is one of the primary environmental concerns with regard to air quality, water quality, habitat protection, land use, hazardous waste transportation, and noise pollution. As the border area population continues to grow, addressing the links between transportation and the environment will only increase in importance.

Border Region Information on Transportation and the Environment (BRITE) was created in 1998 to address the need of information sharing. BRITE is a searchable, on-line database where people can access bibliographic information on what has been written about transportation and environmental issues in the border region. BRITE enables researchers, interest groups, planners, and the general public access to this information. The goal of BRITE is to increase information exchange and collaboration.

BRITE was created in sections, the first of which was Air Quality. Subsequently, three other sections have been researched: Water Quality, Habitat, and Land Use. Future plans for BRITE include sections on Hazardous Waste, Noise, and Regulations.

Website
www.unm.edu/~atr/BRITE
ECOLOGICAL IMPACT ASSESSMENT OF ROAD PROJECTS: A MULTISCALE APPROACH STUDY

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Abstract
The Portuguese road network had an extension of 11408 Km in 1998, corresponding to a density of 1.1 Km/Km². In 1999, a new National Road Plan (PRN2000) was approved, establishing a 16% road network increase over the previous 1985 plan. Several of these new major roads actually cross Natural Parks, Birds Directive and Nature 2000 sites. Habitat loss and fragmentation due to transport infrastructure is clearly a problem in Portugal.

Portuguese major road projects are subjected to an Environmental Impact Assessment (EIA) process. The approaches used in the Ecological Impact Assessment (EcIA) of these road projects are mainly focused in small-scaled effects. Research, involving over 40 Portuguese road EIAs at different project stages, showed that no consistent ecological criteria was presented to establish the EcIA area of study; further, the methodologies utilized for prediction and evaluation of ecological impacts of transport infrastructures did not translate the effects of habitat fragmentation as they did not address the problems of:

• infrastructure as a barrier to the free movement of animals and its implications to population and metapopulation dynamics of the most important species;
• infrastructure as a cause of significative edge effect.

These are aspects that can impair the EcIA process effectiveness, namely by incorrectly identify the areas for the placement of wildlife crossing structures, planned as part of the mitigation measures associated to the transport infrastructure.

The following study presents the application of a methodology (FRAGMet3) that analyses the aspects of habitat fragmentation and deterioration at different scales. This methodology, GIS based, involves: the identification of important natural areas; the delimitation of the area under study; the analysis of potential green corridors and existing linear transport infrastructures; the characterization of the landscape structure for the area directly affected by the infrastructure and for several buffer areas, using soil occupation maps (1:25000). The landscape indices calculated are based in edge, shape, core area and contagion metrics.

The analysis can be carried out on three levels, corresponding to three different project stages: corridor selection; alternative selection and project implementation. The results obtained in each stage can be used to establish priorities for field sampling / monitoring in the following phase.

We describe the results obtained from the application of FRAGMet3 to the highway IC5 - Mondim / Vila pouca de Aguiar (North Portugal) proposed corridors and alternatives. Fragmentation indices showed clear differences between corridors as well as between alternatives. The practical value of this methodology as a base for decision support in the process of EIA and its following stages analysed.
IDENTIFICATION AND MANAGEMENT OF LINKAGE ZONES FOR
GRIZZLY BEARS BETWEEN THE LARGE BLOCKS OF PUBLIC
LAND IN THE NORTHERN ROCKY MOUNTAINS

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Abstract: The fragmentation of carnivore habitat in the Rocky Mountains on both sides of the U.S.-Canada border is an ongoing threat to the survival and recovery of these populations. Human developments are the cause of this fragmentation. Major developments causing fragmentation include private land conversion into homesites and highway construction and improvement. If carnivores such as grizzly bears (Ursus arctos horribilis), wolves, (Canis lupus), wolverines (Gulo gulo), lynx (Lynx lynx), and fishers (Martes pennanti) are to survive and recover to healthy population levels in the Rocky Mountains, the issue of fragmentation must be addressed in a proactive and effective manner.

The grizzly bear (Ursus arctos) is an opportunistic omnivore that readily adapts to a wide range of habitats. Historic distribution of grizzly bears spanned the Northern Hemisphere. However, expanding human populations have reduced or eliminated grizzly bear populations from most of their former range throughout the world. In the conterminous United States, grizzly bears were indiscriminately killed by Anglo-American settlers beginning in the early 1800’s and continuing through the mid-1900’s. By 1970, grizzly bears had been reduced to approximately 2% of their historic range (Servheen 1990; Servheen 1999; USFWS 1993). In 1975 the grizzly bear was listed as threatened under the Endangered Species Act (ESA: 16 U.S.C. 1531-1544). Although healthy populations of grizzly bears persist in Alaska and Canada, some Canadian populations appear threatened by continued development (McLellan and Banci 1999).

Grizzly bears in the lower 48 United States are currently limited to 5 areas in portions of the states of Wyoming, Montana, Idaho, and Washington (Figure 1). Reestablishment of grizzly bears in a sixth area, the Bitterroot Mountains of Idaho and Montana, is planned. This area has ample habitat but no viable grizzly bear population. Despite ESA protection, grizzly bears continue to face human threats. These include mortality, displacement, and habitat fragmentation. If not addressed through appropriate management and mitigation, they will decrease the probability of the grizzly bear’s persistence.

Humans continue to exact a heavy toll on grizzly bear populations by intentionally or accidentally killing them. Intentional killing includes illegal forms of mortality such as poaching, malicious killing, or mistaking grizzly bears for legal game. It also includes removal of nuisance bears by management agencies and bears killed by individuals in defense of life or property. Accidental killing is most often the result of collisions between bears and motor vehicles or trains.

Human activities can displace bears from important habitats such as denning or foraging sites. Displaced bears are forced to limit their use of portions of their habitat, and seek life requisites in less favorable habitats. This can result in reduced reproduction by displaced bears, higher mortality rates due to food stress or lower security, and smaller bear populations due to reduced carrying capacity of remaining habitat. Some bears may choose to continue foraging within close proximity to human developments. These bears suffer much higher mortality rates (Mace and Waller 1998).

Habitat fragmentation occurs when contiguous blocks of habitat are broken into pieces, with the pieces being separated from one another by unsuitable habitats. Habitat fragmentation is usually accompanied by habitat loss, that is, the area of the remaining parcels sum to less than the area of the original contiguous block (Forman 1995). Recent advances in the science of island

**What is a linkage zone?**

The area between larger blocks of habitat where animals can live at certain seasons and where they can find the security they need to successfully move between these larger habitat blocks.

**Linkage zones are broad areas of seasonal habitat where animals can find food, shelter, and security.**
biogeography have led to the development of ecological principles that are relevant to our management of public lands (MacArthur and Wilson 1967). First, the number of species in an area of habitat is proportional to its size. As the area of a habitat is reduced, the number of constituent species is concurrently reduced. Second, the species that disappear first tend to be the largest and rarest (Soule 1983). Populations that are dramatically reduced in size and isolated from one another on small habitat “islands” are at risk of extinction. Extinction risk is elevated because small populations are less able to absorb losses caused by random environmental, genetic, and demographic changes (Gilpin and Soule 1986). Examples of negative environmental changes are catastrophes (e.g. fires or floods), disease epidemics, habitat changes due to climate change, or cyclical food shortages. Random genetic changes include variations in gene frequencies due to genetic drift, population bottlenecks, or inbreeding (Mills and Smouse 1994). Random demographic changes include deleterious shifts in sex and age ratios.

Most species exist as a series of geographically isolated populations separated from each other by habitats having limited support capability and/or higher levels of mortality risk. Such species exist in the landscape as a population of populations, which has been termed a metapopulation (Levins 1970). Lande and Barrowclough (1987) further define metapopulations as geographically separated populations whose range is composed more or less of isolated patches, interconnected through patterns of movement between them. Such a situation describes grizzly bear populations in the Northern Rocky Mountains of the United States and adjacent areas of Canada. The survival and persistence of such metapopulations is dependent upon some level of movement and gene flow between them, especially in environments where demographic challenges exist.

When a species exists as geographically separate populations, as the grizzly does in the Northern Rockies, some level of movement and gene flow between them decreases their probability of extinction (Soule 1987; Harrison 1994; Hanski 1999). The reason for this is that natural environments and pressures from human activities vary over time and such variation can impact survivorship and other demographic variables. When multiple populations exist, there are more chances of differences in natural environmental variation and human pressures between these populations, thereby increasing the probability that some populations will survive environmental and human-induced threats that may result in extirpation of some populations exist.

**The need for linkage consideration:**

The long-term health of populations of carnivores will benefit from linkage wherever possible.

Linkage areas can likely serve multiple carnivore species as well as other wildlife species such as ungulates.

Dramatic changes are occurring in the remaining possible linkage areas due to ongoing human development.

Time to maintain connection opportunities is growing short due to the pace of development on these lands.
Boyce et al. (2001) have demonstrated the value of multiple populations with some dispersal between them to the survival of the grizzly in the Northern Rockies. For multiple populations to act to minimize the probability of extinction of the entire population of grizzly bears in the Northern Rockies, dispersal between different populations must have some acceptable probability of success. The probability of successful movement between grizzly bear populations depends on what is happening in the intervening areas between them. Thus, management of linkage zones to maintain and enhance movement opportunities is a critical part of the successful application of metapopulation theory to grizzly bear conservation.

Fig. 1. Historical distribution of grizzly bears in North America and the location of the six grizzly bear recovery areas.
Why is a linkage zone not a “corridor”?

A “corridor” implies an area just used for travel; however movement between ecosystems by carnivores rarely occurs this way.

For carnivores to get between ecosystems they require habitats that can support their feeding and behavioral needs in these intervening areas.

Linkage zones are areas that will support low density carnivore populations often as seasonal residents - they are not just travel areas.

Habitat Fragmentation and Grizzly Bears
The primary causes of grizzly bear habitat fragmentation are human activities such as road building, and residential, recreational, and commercial developments. The negative effects of human developments and the degree of habitat fragmentation are influenced by the spatial arrangement of the developments. In the Rocky Mountain west, human developments usually occur in linear fashion along valley floors. When development reaches a certain concentration, grizzly bears can no longer cross the valley floor or use it as habitat. These areas have been termed “habitat fracture zones” (Servheen and Sandstrom 1993).

Maintaining connectivity or “linkage” between small isolated populations could prevent many of the detrimental consequences of habitat fragmentation. Immigrants from unaffected populations can bolster populations reduced due to catastrophic events or negative environmental conditions. Connected populations function as one “metapopulation” where local population processes are balanced by immigration and emigration (Hanski and Gilpin 1991). Linkage zones can serve as “fire escapes” that animals can use to avoid temporary catastrophic events. Maintaining linkage between populations can also preserve gene flow, reducing chances of inbreeding and lessening the effects of genetic drift.

Grizzly bear habitat has been fragmented into 6 pieces constituting 2% of their former range. Five grizzly populations exist in the remaining habitat. Valleys containing human developments of varying intensity separate each of these pieces. As human development continues in these intervening areas, they become increasingly effective barriers to grizzly bear movement. Task number 37 in the Grizzly Bear Recovery Plan (USFWS 1993) calls for an evaluation of potential linkage zones within and between grizzly bear recovery areas. This document describes the methods and results of that evaluation.

The Issue of Scale for Linkage Zones and Crossing Sites
The identification of linkage zones is a way to stratify areas where opportunities for movement still exist between large blocks of habitat. Each linkage zone is from one to several miles or more in width. The Linkage Zone Prediction (LZP) model is not designed to predict the most likely locations within each linkage zone that may be used by wildlife to get across each zone. Various scales exist at the landscape level to view the distribution and linkage of wildlife populations. These scales vary from the general distribution of species to site-specific locations where movement routes or sites occur across highways and through linkage zones. Our current level of knowledge does not yet allow us to predict specific crossing routes or sites, or to predict what combinations of topographic features, vegetation characteristics, road structures, or other values that may be most likely to be used by wildlife to select areas to get across linkage zones. Work is now progressing on ways to attempt to predict such crossing sites (Servheen et al. 1998). If it were possible to predict characteristics for crossing sites for grizzly bears and other wildlife species, these would be of great value to highway engineers for placement of crossing structures in the most important locations. This report does not identify these specific crossing sites within each linkage zone. Such identification is a future effort that should be attempted in each linkage zone based on further research.
Analysis Areas
For this paper, we evaluated the extent of habitat fracture and potential for linkage between the Cabinet/Yaak and Bitterroot recovery areas. We have also evaluated the potential for linkage between the Cabinet/Yaak and Selkirk recovery areas; NCDE and Bitterroot recovery areas; and between the NCDE and Cabinet/Yaak recovery areas. We also examined the potential for linkage between the Cabinet Mountains and the Yaak River drainage within the Cabinet/Yaak recovery area. An evaluation of habitat fracture and potential linkage between the Yellowstone recovery area and the NCDE and Bitterroot recovery areas will be addressed in a future document. No movement of grizzly bears between any of these recovery areas south of the Canadian border has been documented to date.

Cabinet/Yaak to Bitterroot - This linkage evaluation area encompassed 3,606 square miles and contained 5 primary transportation corridors: Interstate 90 and Montana state highways 28, 56, 135, and 200. Two of these highways, Interstate 90 and Montana 200, formed potential barriers to grizzly bear movement between the Cabinet/Yaak and Bitterroot recovery areas. Approximately 88% of the area was public land, primarily within the Kootenai, Clearwater, Idaho Panhandle, and Lolo National Forests. The area was mountainous with elevations ranging from 2047 ft in the Clark Fork river valley to 7928 ft in the higher peaks of the Bitterroot Range. Most private land and development occurred in the valleys formed by the Clark Fork and St. Regis rivers and paralleling the 5 primary highways. Timber harvest was the primary use of surrounding National Forest lands, thus forest road densities were relatively high.

Methods
We used a computerized geographic information system (GIS) to model and graphically display the opportunities for grizzly bear movement between recovery areas. GIS allows numerous thematic layers to be combined into one graphic display. Each theme represents a feature of the environment, for example elevation, vegetation type, road networks, etc. Because these themes are combined using a computer algorithm, the process is repeatable over large landscapes.
Fig. 2. Five Linkage Zone Prediction Model evaluation areas with terrain, cites, recovery area boundaries, and major highways shown.
The linkage zone prediction model (LZP) was developed to quantify, in repeatable fashion, the extent to which human development has limited the potential for grizzly bear movement between recovery areas. This model was developed by Mietz (1994) and Sandstrom (1996) and applied to the Evaro Hill and Swan Valley areas of Montana. A derivation of this model was used by Apps (1997) to define linkage areas in Southeastern British Columbia and Southwestern Alberta, Canada.

Previous evaluations of grizzly bear habitat focused on describing vegetation, particularly as potential food resources (Mace and Jonkel 1980, Craighead et al. 1982). More recent research has demonstrated that human activities can also have profound effects on distribution of grizzly bears (Mace et al. 1999). Our LZP model evaluated the potential for bear movement between recovery areas by scoring the landscape based upon 4 data layers: roads, human-developed sites, vegetative cover conditions, and riparian habitat.

Roads
Human transportation corridors and their associated developments can cause fragmentation of the habitats of many different species (Garland and Bradley 1984). Recent research has demonstrated the negative effects of roads on grizzly bears (Archibald et al. 1987; Mattson et al. 1987; McLellan and Shackleton 1988; Kasworm and Manley 1990; Mace et al. 1996, Mace et al. 1999). Although grizzly bears are occasionally killed by motor vehicles on roadways, the primary impact is displacement from preferred habitats (Mace et al. 1999). Conversely, bears not displaced by roads are at higher risk of mortality from hunters, poachers, and management removal.

We compiled digital road data from the US Forest Service and the US Geological Survey for each linkage area. The road network was represented in digital form as “vectors”, and classified as either open to public travel or restricted in some manner. Two thematic layers were created from these data. The first depicted “total motorized access routes” (TMAR), and included all open roads, restricted roads, and motorized trails (IGBC 1994). Restricted roads included roads on which motorized use was restricted yearlong, or seasonally, by a physical obstruction (gate, berm, rocks, or logs). The second layer depicted all open roads, roads with motorized use restricted by a gate or a sign, and trails receiving high use (more than 12 parties per week, IGBC 1994). These “vector” files were converted to a “raster” format in which the landscape is portrayed as a grid of 30x30 meter cells. Each cell is coded as being a road (1) or not (0).

We calculated road density within each linkage zone evaluation area using the TMAR road layer in a “moving circle” analysis. A moving circle analysis assigns each pixel a road density in mi/ mi² based on the number of road cells within a surrounding 1 mi diameter circle. The circle moves across the evaluation area, calculating road density, cell by cell. Road density values were then grouped into 4 categories: 0 mi/ mi², 0.01 – 1.00 mi/ mi², 1.01 – 2 mi/ mi², and > 2 mi/ mi². The categories were those used by Mace and Manley (1993) to measure and report effects of road density on grizzly bears.

The second road layer was used to create a map of secure core areas (SCA). All open roads, roads restricted by a gate or a sign, and trails receiving high use, received a 500 m buffer. All areas outside this buffer were considered SCA. Areas within a SCA are considered to be less impacted by human activity and where grizzly bears are at lower risk of displacement and mortality risk, thus are given a lower impact score (minimal), than areas outside SCA. The interaction between roads, SCA, developed sites, and vegetation were represented by an impact level ranking (Table 1).
Developed sites
Grizzly bear survival and habitat-use patterns are strongly influenced by the intensity of human activity around developed sites. Grizzly bears may respond negatively, neutrally, or positively. A negative response is avoidance of the area surrounding a developed site. A positive response is attraction to developed sites due to the presence of garbage or foods. Both negative and positive responses can be detrimental to grizzly bears.

Avoidance of developed sites may result in loss of important habitats while attraction may result in increased mortality. Developed sites usually become permanent features of the grizzly bear’s environment, and therefore need to be accommodated by land managers charged with grizzly bear conservation.

Input data for this layer consisted of digital maps of developed sites represented as point and polygon features. Polygon features represented campgrounds, livestock operations, communities, and other places that cover an area too large to be represented by a point. Data were obtained from USFS and USGS cartographic feature files. Each developed site represented a “human influence zone” which was then buffered by 60, 120, or 210 m depending on the type of activity occurring at the site. Various types of activities occurring at developed sites were subjectively categorized as to their “danger” to grizzly bears based on the judgment of bear biologists (Table 2).

There was no empirical basis for establishing these categories, so we employed a “best judgment” methodology (USFS 1994). In the LZP model, we coded all human influence zones as having a “high” or the strongest impact level. Human developments often represent permanent human presence and reduced land management opportunities. Thus, a developed site has a long term, permanent, negative impact on grizzly bear habitat quality. We assumed that the influence of humans on bears declined as distance from a developed site increased. We incorporated this into the LZP model by creating two 120 m concentric zones around each human impact zone and classifying them as having moderate and low impact levels respectively. Distances greater than 240 m from the outer boundary of a human influence zone were considered neutral.

Cover conditions
Hiding cover is vegetation capable of shielding an animal from visual detection. Many definitions of hiding cover exist and tend to be specific to the species of interest. We used the Flathead National Forest definition of grizzly bear non-hiding cover (USFS 1992), which is “vegetation not capable of hiding 90% of an adult grizzly bear at 200 feet.” These open areas occurred naturally as a result of recent fires, as a consequence of environmental factors (climatic, edaphic) that discourage vegetation growth, and as a result of human activities, such as logging.

Grizzly bears seldom venture far from hiding cover during daylight hours in areas with frequent human activity (Blanchard 1978; Schallenberger and Jonkel 1980; Aune and Kasworm 1989), but seem unaffected by cover conditions where human presence is minimal (Servheen 1981). Open areas where humans are present are usually associated with roads or trails. Bears in direct view of roads and vehicles usually flee, whereas grizzly bears in protective cover are less affected by human presence (McLellan and Mace 1985; McLellan and Shackleton 1989; McLellan 1990). We therefore assumed that open areas have a negative affect on habitat quality only if within 500 m of an open road, a road with use restricted by a gate or a sign, or a high-use trail outside SCAs.
Table 1
Estimated levels of impact on habitat quality from different categories of human activity and vegetation hiding cover conditions (Sandstrom 1996).

<table>
<thead>
<tr>
<th>Category of condition</th>
<th>Impact level</th>
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<tbody>
<tr>
<td>Road Density (RD) 0 mi/mi², inside SCA¹</td>
<td>Beneficial</td>
</tr>
<tr>
<td>Within riparian area</td>
<td>Beneficial</td>
</tr>
<tr>
<td>RD 0 mi/mi², outside SCA</td>
<td>Neutral</td>
</tr>
<tr>
<td>RD 0.01 – 1.00 mi/mi², inside SCA</td>
<td>Neutral</td>
</tr>
<tr>
<td>&gt; 240 m from a human influence zone</td>
<td>Neutral</td>
</tr>
<tr>
<td>Area providing hiding cover</td>
<td>Neutral</td>
</tr>
<tr>
<td>Open area, inside SCA</td>
<td>Neutral</td>
</tr>
<tr>
<td>Outside riparian area</td>
<td>Neutral</td>
</tr>
<tr>
<td>RD 0.01 – 1.00 mi/mi², outside SCA</td>
<td>Minimal</td>
</tr>
<tr>
<td>RD 1.01 – 2.00 mi/mi², inside SCA</td>
<td>Minimal</td>
</tr>
<tr>
<td>Edge, outside SCA</td>
<td>Minimal</td>
</tr>
<tr>
<td>RD 1.01 – 2.00 mi/mi², outside SCA</td>
<td>Low</td>
</tr>
<tr>
<td>RD &gt; 2.00 mi/mi², inside SCA</td>
<td>Low</td>
</tr>
<tr>
<td>120 – 240 m from a human influence zone</td>
<td>Low</td>
</tr>
<tr>
<td>RD &gt; 2.00 mi/mi², outside SCA</td>
<td>Moderate</td>
</tr>
<tr>
<td>&lt; 120 m from a human influence zone</td>
<td>Moderate</td>
</tr>
<tr>
<td>Open area, outside SCA</td>
<td>Moderate</td>
</tr>
<tr>
<td>Within a human influence zone</td>
<td>High</td>
</tr>
</tbody>
</table>

Secure Core Areas (SCA) are areas > 500 meters from open roads, or roads with motorized use restricted by a gate or a sign, and non-motorized trails receiving more than 12 parties per week. Roads with use restricted by berms, rocks, or logs could exist inside SCAs.

1SCA = secure core area
Table 2
Human influence zone buffer sizes, types, and danger categories (Sandstrom 1996).

<table>
<thead>
<tr>
<th>Influence zone radius</th>
<th>Type of developed site</th>
<th>CEM Danger Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Fishing access, boat launch, trailhead, Miscellaneous structure</td>
<td>low</td>
</tr>
<tr>
<td>120</td>
<td>Campsite, picnic site, work station, Outfitter camp, viewpoint</td>
<td>medium</td>
</tr>
<tr>
<td>210</td>
<td>Residence, livestock operation, Community, school, manufacturing business, church, campground, garbage dump, restaurant, summer camp, guest lodge</td>
<td>high</td>
</tr>
</tbody>
</table>

We used LANDSAT Thematic Mapper satellite imagery and unsupervised classification (Ma 1994) to delineate areas of hiding cover. Open cover/non-cover edges were delineated with a 30 m buffer to represent use of forest edges by grizzly bears. In the LZP model, open areas were classified the same as cover areas within SCAs, but were assigned a “moderate” impact when outside SCAs. Edge areas outside SCAs were assigned a “minimal” impact.

Riparian areas
Previous research has shown that riparian areas are important to grizzly bears and generally provide more food and security than other cover types (Mealey et al. 1977; Mace and Jonkel 1979; Servheen 1983; Craighead 1982; Aune et al. 1984; Kasworm 1985; Almack 1986). In many cases, riparian areas run perpendicular to the linear arrangement of human developments along higher-order waterways, thus facilitating grizzly bear movement through developed areas.

We developed a computer model to predict the occurrence of riparian areas because detailed vegetation mapping was not available in most of the LZP model evaluation areas (Sandstrom 1996). This model mapped the potential for riparian vegetation based on the slope of land adjacent to waterways. Using digital hydrography and elevation data from USGS (USGS 1987a, b), we buffered existing waterways by an amount proportional to the change in elevation out to a maximum of 210 m. Two caveats apply to this riparian model. First, this predictive riparian model was developed for use at landscape scales and where little field mapping has occurred. Small, but important, micro-sites such as seeps were excluded because of the spatial resolution of the mapping process. The riparian model should not be considered a replacement for site-specific field mapping. Second, the model does not determine specific vegetation types within the riparian area, which may include open water, rocks, wet meadows, deciduous shrubs, and coniferous forest.

Land ownership
In the western U.S., much of the land useful for human development lies within valley bottoms. Here, soils and terrain are suited for agriculture and transportation systems, and water is available for drinking and irrigation. These desirable and productive valley bottoms are primarily privately owned. However, because of their linear nature, they serve to further fragment remaining grizzly bear habitat. Thus, land ownership patterns can indicate areas of habitat fragmentation. Land ownership information was not directly incorporated into the LZP model, but was used to help identify areas where linkage zone opportunities might best be preserved. Digital land ownership files denoting either publicly or privately owned lands were obtained from the Wildlife Spatial Analysis Lab at the University of Montana, Missoula.

Highway structure and volume
The LZP model does not include highway features, form, or traffic volume in its scored map output. Highways are important habitat fragmentation factors and must be accounted for in any management scheme that seeks to facilitate linkage for bears and other wildlife species. The purpose of the LZP model is to identify areas where human activity levels still allow some opportunity for movement. Getting wildlife across the highways within linkage zone areas is important and recommendations on this issue are detailed in the section on management of linkage zones.
Final LZP model score
Each of the 4 input data layers (roads, developed sites, cover conditions, riparian areas) were combined into one new layer displaying the combined impact of each of these factors on habitat quality. The combined scores were then divided into 4 categories based upon subjective evaluation. In general, to be considered in the “minimal” combined impact category, the pixel had to have “neutral” or “beneficial” impact values for all 4 individual layers, or only one condition have a “minimal” or “low” impact value. To be considered in the “low” combined impact category, 2 conditions could be in the “minimal” or “low” category, or 1 condition in the “minimal” or “low” category and/or 1 condition in the “moderate” category while the others had to be “beneficial” or “neutral”. To be considered in the “moderate” or “high” combined impact category, individual impact values had to be different combinations of “low”, “moderate”, and “high” impact values. When interpreting these combinations it is important to acknowledge how different human impacts interact with each other. For example, residences in valley bottoms are nearly always associated with some level of road density and often with open areas. The model is indirectly driven by presence of developed sites, not because they were given the highest impact category, but because developed sites almost always occur in association with roads and open areas of limited visual cover (Table 1).

Delineation of linkage zones
Examining the maps showing combined impact scores allowed identification of Linkage Zones. The goal was to locate areas where grizzly bears could move between large blocks of habitat on public lands with the least conflict with people. To qualify as a linkage zone, an area had to be within the “minimal” or “low” combined impact categories and span an area between the large blocks of habitat on federal lands in a continuous fashion. Single, small areas in the “moderate” or “high” combined impact category surrounded by areas in the “minimal” and “low” combined impact categories (usually lone developed sites surrounded by forested areas) could also be included in linkage zones. Extensive areas within the “moderate” and “high” combined impact categories were excluded as linkage zones. Such areas were usually within human influence zones. To facilitate identification of linkage zones, developed corridors were displayed as yellow/black graphics, where yellow represented “low” and “minimal” combined impact categories and black represented “moderate” and “high” combined impact categories. LZP model outputs were also displayed as 3D surfaces viewed obliquely, thus giving the reader a “birds-eye” view of potential linkage zones.

Results
Each of the linkage zone evaluation areas had different amounts of habitat fragmentation, thus precluding movement between recovery areas to varying degrees. However, some common themes emerged. As stated in the introduction, most development occurred on private lands in valley bottoms. These developments generally were within human influence zones and thus ascribed “moderate” to “high” combined impact categories. Most of the public lands fell within the “minimal” or “low” combined impact categories. Some areas have a “moderate” score due to the presence of clearcuts and high road densities, or due to presence of a recreation site. Public lands scored as “moderate” were discontinuously distributed across the landscape, whereas private lands scored as “moderate” or “high” had a linear distribution along higher order waterways or primary transportation systems.

Example of the results – the Cabinet/Yaak to Bitterroot Linkage Area
The most severe habitat fragmentation between the Cabinet/Yaak and Bitterroot ecosystems occurs along Montana Highway 200 between Plains, Montana and the Idaho border. Some fragmentation also occurs along Interstate 90 (I-90), from east of Superior, Montana to Lookout Pass (Figures 3 and 4, end of paper), but this is mostly limited to the town sites along the route as most land adjacent to I-90 in this area is in Federal ownership (Figure 5, end of paper). Most remaining lands along the Interstate highway were “minimal” or “low” categories and did not appear to be an impediment to linkage, except for the fact that a four lane interstate highway runs through these areas. Little development has occurred in the I-90 corridor between St. Regis and Deborgia, offering ample opportunity for linkage (Figure 4).
Discussion

This assessment does not present a bright outlook for potential connectivity between recovery areas. Fragmentation was complete, or nearly so, between all the recovery areas. Development has continued at a record pace and it is likely that linkage areas we identified may become unavailable within the next decade. However, the following discussion of the LZP model may inject some cause for optimism.

A model is an abstraction of reality that simplifies natural processes into understandable components. The LZP model attempted to quantify those components most responsible for influencing grizzly bear movements, then use those components to identify places where grizzly bears were most likely to traverse human developments. The model operated with geographic data collected at landscape scales. Thus it was insensitive to fine scale environmental patterns. Grizzly bears, on the other hand, are well equipped to process information collected at fine scales. Model outputs reflected the quality of input data. Errors in digital maps of terrain, human developments, and roads were reflected in model results. Thus the LZP model may not accurately predict where grizzly bears will choose to cross-fractured habitat unerringly. Further, human development is a continuous process. Digital maps of roads and developments, that were accurate at the time we obtained them, may not show recent developments.

The LZP model should be considered a point of departure for more intensive and accurate mapping of potential linkage zones. Although we felt confident that the model accurately portrayed places where grizzly bears may cross-fractured habitat with the least risk, implementation of conservation strategies will require that the model be validated in the field. The LZP model also contains many assumptions about the relative risk of each of its components to grizzly bears. Some of these assumptions are poorly substantiated due to the lack of pertinent research, for example the strength of reaction to human developments in relation to cover conditions. In these cases, we used our best judgment to estimate risk and aversion.

As the number of linkage zones between recovery areas decreases, the likelihood of remaining linkage areas being utilized diminishes. The spatial extent of remaining linkage areas will become very small relative to movements of grizzly bears. Bears will then be more likely to attempt crossings in less safe areas, increasing their risk of mortality. There is no research concerning minimum required size of linkage zones or at what level linkage areas become ineffective for grizzly bears. Such information can only be obtained through long term and intensive monitoring of grizzly bears. Recent advancements in GPS technology may allow researchers to answer questions of this nature in the near future.

The LZP model, as applied here, does not consider habitat quality as an important factor governing bear movements. It does use presence of riparian areas, modeled from terrain data, as a factor, but this treatment is superficial at best. The reason for this is that classified and validated maps of grizzly bear habitat quality are generally non-existent. Creating them from field research is time consuming and expensive. However recent research into grizzly bear habitat selectivity using satellite imagery and radio telemetry data have found strong associations between telemetry locations and vegetation reflectance patterns (Manley et al. 1992; Mace et al. 1999).

It may be possible to map grizzly bear habitat quality across broad landscapes using satellite imagery. Such information could then be incorporated into a more habitat-specific linkage prediction model. Private landowners who have already worked cooperatively to implement linkage zones in local communities will write this protocol. This private lands protocol will describe the best ways to work with local landowners in order to obtain understanding, agreement, and ownership of the ideas necessary for linkage zone management. These task force reports can then be the template to implement management opportunities on public lands in the approach zones to each linkage zone, to implement planning and outreach with private landowners in each area, and to incorporate linkage zone crossing opportunities into highway planning in each linkage zone.

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Biographical Sketch: Dr. Christopher Servheen, Adjunct Associate Professor in the Wildlife Biology Program at the University of Montana, is the Grizzly Bear Recovery Coordinator for the U.S. Fish and Wildlife Service in Missoula, Montana. His research interests involve bear conservation and management as well as the relationships between human activities and bear distribution and survival. Most of Chris'
current work, and that of his graduate students, focuses on the impacts of highways and human developments on habitat fragmentation for large carnivores in the Rocky Mountains. He also works with state and federal highway departments in understanding and developing ways to get animals across highways. Through Chris’ international work, he maintains close cooperative relationships with IUCN, WWF, and other international conservation organizations. Chris holds a B.S. in Zoology/Wildlife Biology from the University of Montana, a M.S. in Wildlife Biology from the University of Washington, and a Ph.D. in Forestry/Wildlife Biology from the University of Montana.

References


Fig. 3. Landscape view of Linkage Zone Prediction Model output looking northwest from Superior to St. Regis, Montana along I-90.
Fig. 4. Landscape view of Linkage Zone Prediction Model output looking northwest from St. Regis, Montana to Lookout Pass along I-90. This is a critical linkage connection, the success of which will be determined by the permeability of the highway and what Montana DOT does to address linkage in this area.
Fig. 5. Land ownership and linkage zones along I-90 from St. Regis, Montana to Lookout Pass on the Idaho line. Linkage zones are within the red arrow areas. Green is USFS, blue is state, white is private.
The simultaneous three-pronged approach to linkage zone implementation that will address all the necessary issues:

**Issue**

- Highways
- Private Lands
- Public Lands

**Tools**

- Highway task force report on best management practices
- Protocol on how to work with private land owners and local governments to identify linkage opportunities
- Task force report on best management practices on public lands

**Who**

- Highways task group with a core of state and federal DOTs, USFS, FWS, state fish and game depts., and others
- Site-specific task groups for each linkage zone involving private lands specialists, local landowners, land conservation organizations, and county officials
- State and federal public land managers within each linkage zone along with state fish and game depts., FWS, and others

**Product**

- Consideration of linkage needs in long-term planning, project design, and highway and bridge repair/rebuilds
- Cooperative efforts with local citizens and county governments in each linkage area
- Consideration of linkage needs in forest plan revisions, and land management planning decisions

Fig. 6. The three issues that need to be addressed to implement linkage zones.
ENDANGERED SPECIES PROTECTION AND SECTION 7 COORDINATION: BUILDING CONSSENSUS AMONG AGENCIES AND THE PUBLIC

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The Project
The Maryland Route 30 Bypass at Hampstead, Carroll County, Maryland is a long awaited 4.5 mile $27 million safety and congestion relief project proposed by the Maryland State Highway Administration (MD SHA). However, an unanticipated problem arose during the final stages of design and prior to the submittal of state and federal environmental permits. Late in 1997, the northern population of a small turtle (Clemmys muhlenbergi), the bog turtle, was listed as a threatened species under the Endangered Species Act. The rural residential and agricultural lands surrounding Hampstead provide essential habitat for this rare turtle. While many saw this as potential threat to the project, others saw this as an opportunity for a creative approach for habitat and species protection.

Section 7 Requirements
Section 7(a)(2) of The Endangered Species Act requires that Federal agencies, in this case the Federal Highway Administration (FHWA), consult with the U.S. Fish and Wildlife Service (FWS) to ensure that actions they fund, authorize, permit, or otherwise carry out will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats. A biological assessment is required to document the potential effects of the project on the listed species. When FWS issues a biological opinion, it will contain reasonable and prudent alternatives to the project including an incidental take statement. “Take” is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collection or attempting to engage in any such conduct. “Harm” is further defined to include significant habitat modification or degradation that may result in death or injury to a listed species by impairing behavioral patterns necessary to continue life history requirements such as breeding, feeding, and sheltering. Takings that result from, but are not the purpose of carrying out an otherwise lawful activity conducted by a federal agency or its applicant is known as an incidental take.

Building Consensus
MD SHA decided that a biological assessment for the Maryland Route 30 project would be needed for the bog turtle in order to fulfill FHWA/MD SHA’s responsibilities under Section 7. It was further decided that an inclusive process of assembling the bioassessment would be in the best interests of the Federal and State resource agencies as well as the County, the Town of Hampstead, and various business interests all of whom were anxious to see this highway project move forward. Consequently, a bioassessment team was set up in 1998 to keep all interested groups apprised of the progress of research findings. A further benefit of this inclusive team approach was to enable the participants to become stakeholders in providing an imaginative solution to what would normally be perceived as a conflict between opposing interest groups.

The first obstacle placed in our path was the initial resistance of those who were focused on the need for the project and what they felt would be another unnecessary delay. This obstacle was overcome by explaining that the process of coordination with FWS was an essential ingredient in moving the project forward and that a cooperative effort would facilitate coordination. The team was then able to focus on learning more about this threatened species and how to allow for its coexistence with the proposed roadway. Providing for the bog turtle and its habitat has now become a primary goal in the cooperative development of the bioassessment.

Another problem that arose was how to coordinate assessment activities with the media. In the initial stages, the suspected controversy between conflicting interests was promoted as the driving theme of various news stories. The team moved quickly to change the focus of these reports. Those whose quotes in the press were being used to fuel this controversy were advised of the benefits of promoting the inclusive efforts being undertaken on behalf of the project. These benefits include a timely and informed opinion by the FWS, as well
as the town and county becoming primary examples of conflict resolution regarding important natural resources.

The Approach
Surveys completed in Maryland have recorded a 43 percent decline in historically occupied bog turtle sites between 1976 and 1994. Conservation efforts have focused on habitat protection and restoration usually at the scale of an individual wetland. However, a broader scope of analysis has been undertaken to satisfy concerns of 7(a)(2) for this bioassessment. Radio telemetry is being used to track turtle movements and to better understand typical home range activities within occupied wetlands and along travel corridors. Instead of looking only at the individual wetland that provides habitat for the bog turtle, a metapopulation approach to species conservation is being analyzed. This approach focuses on the need to protect connectivity between individual sites so that sub populations remain viable and healthy through the introduction of periodic, genetic variation. Individual populations have been shown to decline over time due to the isolation of the gene pool.

Additionally, to insure that the project does no “harm” as defined in 7(a)(2), hydrologic research is being conducted to insure that surface and subsurface components will not be altered in such a way as to affect wetland hydrology or hydroperiod. Data from deep groundwater monitoring wells, shallow groundwater piezometers, stream flow gauges, weather stations, soil chemistry and water quality samples is being analyzed to insure that the roadway project will be designed in a way that maintains the viability of these critical wetland habitats.

A final component of the bioassessment will be a Habitat Management Plan that will make recommendations for future protection and management of the bog turtle. Using project monies dedicated to environmental mitigation and funds provided through the Transportation Equity Act for the 21st century (TEA21), FHWA and SHA are proposing the establishment of a metapopulation bio-reserve that will protect this species and its habitat through land purchases and/or perpetual easements. The bio-reserve will include individual wetlands as well as corridors to maintain gene flow. The team is seeking a partnering effort among the federal, state, county, local, and private interests to make acquisition a reality. Once designed, a management strategy will be developed that will insure the bio-reserve remains optimal for species survival.

Conclusion
Environmental issues and processes need not be a wedge driven between competing interests. Inclusion and dialog throughout the coordination process is showing that a consensus can be built that not only results in a better project but also serves to insure the long term viability of a valuable natural resource. If successful, this approach may provide a blueprint for resolving similar conflicts.

Biographical Sketch: Bill Branch is an environmental analyst with the Maryland State Highway Administration’s Office of Environmental Design. With a B.A. in Biology, Bill has 26 years experience in providing solutions to the conflicts that arise between highway construction and environmental protection. He has written on various topics including wetland creation, use of native plants, and the endangered species consultation process.
Abstract: The Research and Special Programs Administration (RSPA) of the Department of Transportation is required to identify areas unusually sensitive to environmental damage in the event of a hazardous liquid pipeline accident. Pipeline operators that can affect these “unusually sensitive areas” (USAs) must develop and follow an integrity management program to continually assess and evaluate the integrity of their pipelines. After extensive consultation and pilot testing with conservation biologists, government agencies, drinking water experts, and other stakeholders, a process has been developed to identify USAs for both ecological resources and drinking water. The process begins by designating and assessing environmentally sensitive areas (ESAs), then determining which ESAs are potentially more susceptible to permanent or long-term damage from a hazardous liquid release. Finally, criteria were identified to determine which resources can be affected by a release and sustain permanent or long-term damage. Ecological USAs are defined and mapped based on the presence of critically imperiled species, assemblages of multiple imperiled or endangered species, the presence of sensitive species that are aquatically dependent or have a limited terrestrial range, and concentrations of migratory waterbirds. Mapping these areas nationwide made use of ecological data from several sources, the majority coming from the Association for Biodiversity Information (ABI). Once created, maps of the USAs are posted on the RSPA Internet website in viewable format (http://www.npms.rspa.dot.gov/), and electronic versions of the GIS data layers are made available to pipeline operators for use with their GIS pipeline mapping systems. To identify and locate USAs, RSPA needed ecological data in a timely and standardized format. This included the location of imperiled, threatened, and endangered species. ABI aggregated data on the location and condition of species produced by its member organizations—the Natural Heritage Programs. This project represents the first time that detailed natural heritage data on specific locations of imperiled and endangered species have been aggregated nationwide for natural resource protection purposes. Previously, accomplishing this would have required a planning or regulatory agency to seek data from over fifty organizations across the country. ABI’s aggregated dataset represents the most authoritative collection of locational information on imperiled species available. This paper focuses on the process developed to identify USAs, development and provision of ecological data, and the mapping of USAs across the country.

Introduction
The pipeline safety statute (49 U.S.C. § 60109) requires the U.S. DOT’s Office of Pipeline Safety (OPS) to prescribe standards for identifying hazardous liquid (petroleum, petroleum products) pipelines in areas that OPS describes as unusually sensitive to environmental damage in the event of a hazardous liquid pipeline accident. These are termed unusually sensitive areas (USAs). When describing USAs, the statute asked OPS to consider areas where a pipeline rupture would likely cause permanent or long-term environmental damage.

Pipeline operators that can affect USAs must develop and follow an integrity management program to continually assess and evaluate the integrity of the pipeline through internal inspection or pressure testing and data integration and analysis. This includes a comprehensive evaluation of the entire range of threats to the integrity of the pipeline by analyzing all available information about the pipeline and the consequences of a failure. Pipeline operators must consider potential for damage due to excavation, data gathered through the required integrity assessment, results of other inspections and tests, and information about how a failure could affect an USAs. Pipeline operators must also consider USAs that are adjacent to navigable waters for oil spill response planning.

OPS held a series of public meetings, technical workshops and pilot tests to define USAs. Federal and state agencies, the hazardous liquid pipeline industry, drinking water experts, conservation biologists, and the public participated in these events and provided input. Using this information, OPS developed a model to identify USAs for both drinking water and ecological resources. It was decided that the creation of USAs would rely on readily available data and that OPS, with the help of other agencies, would define, identify, and locate USAs to avoid subjectivity and keep resource sensitivity uniform on a national basis.
The USA ecological model begins by identifying ecological resources that are more sensitive to a hazardous liquid release, termed “ecological areas of primary concern.” Filter criteria are then applied to the areas of primary concern to determine which resource areas could suffer permanent or long-term effects from a potential hazardous liquid release. Filter criteria are designed to consider the ability of the resource to be impacted by a release, the uniqueness of the resource, if the resource is irreparable or irreplaceable, if there are substitutes for the resource, and the criticality of the resource.

On December 21, 2000, OPS published a final rule defining USAs. The following focuses on defining the ecological areas of primary concern, the filtering criteria that defines USAs, how OPS is mapping these ecological USAs, and background information on the development of the ecological data developed by the Association for Biodiversity Information.

Defining Ecological Areas of Primary Concern
Ecological areas of primary concern focus on characteristics of rarity, imperilment, or the potential for loss of large segments of an abundant population during periods of migratory concentration. These include threatened and endangered (T&E) species, critically imperiled and imperiled species and ecological communities, depleted marine mammals, and migratory waterbird concentration areas.

- Areas Containing Federally Listed Threatened and Endangered (T&E) Species: These areas contain known occurrences of animal and plant species that have been listed and are protected under the Endangered Species Act of 1973, as amended (ESA73). There are currently more than 1,000 listed T&E species in the United States. The term species includes species, subspecies, and distinct vertebrate populations. In addition, a species that has been proposed or is a candidate to become a T&E species will become an ecological area of primary concern upon its final listing as a T&E species in the Federal Register.

- Areas Containing Critically Imperiled and Imperiled Species and Subtaxa: These areas contain known occurrences of animal and plant species or ecological communities that have such limited distribution that a hazardous liquid pipeline release could affect a significant percentage of the species. There are a number of species that are at risk of extinction due to their extremely restricted distribution or limited numbers. These resources are identified, ranked, and inventoried by Natural Heritage Programs (NHP) and Conservation Data Centers (CDC) in conjunction with The Nature Conservancy (TNC) and the Association for Biodiversity Information (ABI). These groups assign a Global (or range-wide) Conservation Status Rank (GRANKs) to each species. This rank is based on several specific factors, including the number of known occurrences or populations, number of individuals, health of the population, its extinction potential, whether it is experiencing an increasing or decreasing trend, and if there are known threats to the species. Ecological areas of primary concern include occurrences of species and subtaxa with the following Global Ranks. Additional information on Conservation Status Ranks is provided in the section on data development at the end of this paper.
  - Critically imperiled: These species demonstrate extreme rarity (5 or fewer occurrences or fewer than 1,000 individuals) or extreme vulnerability to extinction due to some natural or man-made factor. About 4,300 species in the United States are ranked as critically imperiled globally. Rare or extremely vulnerable subtaxa that are critically imperiled are included in this category, despite the conservation status of the species as a whole.
  - Imperiled: Imperiled species demonstrate rarity (6 to 20 occurrences or 1,000 to 3,000 individuals) or vulnerability to extinction due to some natural or man-made factor. About 3,700 species in the United States are ranked as imperiled. Rare or vulnerable subtaxa that are imperiled are included in this category, despite the conservation status of the species as a whole.

- Areas containing Depleted Marine Mammal Species: These areas contain known occurrences of depleted species identified and protected under the Marine Mammal Protection Act (MMPA) of 1972, as amended. The term “depleted” refers to marine mammal species that are listed as T&E or are below their optimum sustainable populations (16 U.S.C. 1362). The term “species” includes species, subspecies, or population stocks. Currently 18 species are listed as “depleted” under the MMPA.

- Areas Containing a Large Percentage of the World’s Population of a Migratory Waterbird Species: These areas contain very high concentrations of the world’s population of a species for a short time. For example, there are portions of the Delaware Bay where a major portion of the world population of red knot (a shorebird species) stop-over to feed during migration. Two programs of international significance are
responsible for identifying and delimiting areas where significant populations of migratory waterbirds congregate during critical periods. First, the Western Hemisphere Shorebird Reserve Network (WHSRN) ranks migratory shorebird concentration areas into four categories: Hemispheric Reserves, International Reserves, Regional Reserves, and Endangered Species Reserves. Hemispheric reserves host at least 500,000 shorebirds annually or 30% of a species flyway population. International reserves host 100,000 shorebirds annually or 15% of a species flyway population. Regional reserves host 20,000 shorebirds annually or 5% of a species flyway population. Endangered species reserves include areas critical to the survival of endangered species and no minimum number of birds is required. Second, the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar) identifies globally critical wetland areas supporting migratory waterfowl. Ramsar sites are globally critical wetland areas that support migratory waterfowl. These include wetland areas that regularly support 20,000 waterfowl; wetland areas that regularly support substantial numbers of individuals from particular groups of waterfowl, indicative of wetland values, productivity, or diversity; and wetland areas that regularly support 1% of the individuals in a population of one species or subspecies of waterfowl.

Filter Criteria that Define an Ecological USA
The following filter criteria are applied to the ecological resource areas of primary concern to identify unusually sensitive areas. The filters identify areas that contain species that are vulnerable to extinction, are critical to multiple sensitive species, or could impact a large percent of a species population:

- Areas containing critically imperiled species or ecological communities shall be USAs;
- Areas containing multi-species assemblages are USAs. Multi-species assemblage areas are areas where three or more different critically imperiled or imperiled species or ecological communities, threatened and endangered species, depleted marine mammals, or migratory waterbird concentrations co-occur;
- Migratory waterbird concentration areas, other than regional WHSRN sites, shall be USAs;
- Areas containing candidate species (critically imperiled and imperiled species, threatened and endangered species, and depleted marine mammals) or ecological community (critically imperiled and imperiled ecological communities) occurrences of excellent quality and good quality (identified using rounded Element Occurrence Ranks of "A" and "B") shall be USAs (see discussion of Element Occurrence Rank in the data development section at the end of this paper); and
- Areas containing candidate species and ecological communities that are aquatic or aquatic-dependent, or are terrestrial with a limited range shall be USAs.

The filter criteria are applied in a multi-tiered process where all ecological areas of primary concern receive repetitive consideration for USA status. For example, an ecological area of primary concern is first subjected to Filter Criterion 1, areas with critically imperiled species, and may be designated an USA at this point. If the ecological area of primary concern does not meet Filter Criteria 1, the process continues for the remaining filter criteria. If the ecological area of primary concern does not meet any filter criteria, it remains an ecological area of primary concern. All ecological areas of primary concern will be periodically reviewed to consider changes in resource information or status.

Identifying Ecological USAs
A multitude of data have to be collected and processed in order to identify and map ecological USAs. These data include point, polygon, and region species locations and attributes; polygon boundaries for management areas and other features identified as migratory waterbird concentrations; linear and polygonal hydrography; state boundaries; etc.

A Geographic Information System (GIS) is used to integrate the data and apply the USA filter criteria. OPS developed a GIS computer model to integrate the gathered information and automate USA identification. The GIS application of filter criteria is the most complex portion of the process. This section discusses the ecological data that were collected and how the data were processed.

Collecting Data
OPS has acquired various datasets in order to identify ecological USAs. These include a "Multi-Jurisdictional Dataset" (MJD) of plant and animal species from ABI and the Natural Heritage Network; biological resource data from the Environmental Sensitivity Index (ESI) datasets; habitat association and life-history information for each species and ecological community represented in the ESIs and for each species represented in the ABI
dataset; descriptions, maps, and spatial data for Ramsar and WHSRN sites; a hydrography data layer depicting surface water features; a digital layer depicting state boundaries; and descriptions, maps or data delineating the limit of state waters.

TNC and ABI are working with the natural heritage network to create the MJD. OPS entered into a cooperative agreement with TNC and ABI to obtain access to the MJD. ABI compiles and aggregates state heritage data on a national scale into the MJD. The MJD includes element occurrence records (locations and attributes for the species or community) and supporting element classification data for T&E, critically imperiled, and imperiled species. The spatial component of the MJD consists primarily of points. For some states, the spatial data included region or polygon data in addition to or in place of the point data. A variety of attribute fields are provided with the MJD, and are described in more detail in the data development section of this paper. These include (listed alphabetically): ELCODE (unique identifier for each element, e.g. species or community), EOCODE (unique identifier for each occurrence), EODATA (various information unique to occurrence), EORANK (quality rank for occurrences), EORANKROUND (rounded EORANK), EOTYPE (type of occurrence), GCOMNAME (global common name), GNAME (global scientific name), GRANK (global conservation status rank), PRECISION (spatial precision by occurrence), ROUNDEDGRANK (rounded GRANK), SRANK (state conservation status rank), USESA (federal T&E listing status, by species), and USESA_EO (federal T&E listing status, by occurrence). ABI performed quality control/quality assurance and data standardization, generated summary statistics and descriptive metadata, and projected the data prior to its delivery to OPS. For more information on natural heritage datasets and programs, see Stein et al. (Stein 2000), http://www.abi.org/, and http://www.abi.org/nhp/us_programs.htm.

ABI and TNC also provided a "master species database". This database included information on ELCODEs, common names, scientific names, GRANKs, federal T&E status, and habitat associations for all potential candidate species tracked by the various NHPs. Habitat fields included with this dataset were GHABCOM (habitat comments) and ALL_HAB_TYPES (a list of habitats used).

OPS obtained additional information on candidate species habitats and ranges using ABI's NatureServe on-line database (ABI 2000, http://www.natureserve.org/). OPS also used introductory text, references, and metadata associated with the ESI databases; U.S. Department of Agriculture's (USDA) PLANTS database (USDA NRCS 1999, http://plants.usda.gov/plants/); and various other sources specific to each state.

ABI frequently updates T&E species and occurrence information, and did so for the datasets used in the model prior to their delivery to OPS. In addition, OPS checked the status of T&E species using on-line databases maintained by the U.S. Fish and Wildlife Service (USFWS) (http://endangered.fws.gov/) and the NMFS Office of Protected Resources (http://www.nmfs.noaa.gov/prot_res/prot_res.html). The NMFS site was also used to obtain depleted marine mammal listings.

The National Oceanographic and Atmospheric Administration (NOAA), the Minerals Management Service (MMS), and various state agencies develop and publish ESI datasets. Biological resources data from the ESIs include polygon or region data as well as point data. Each dataset contains several GIS coverages, each treating a different biological resource type (birds, reptiles, marine mammals, etc.). The following relational database tables are required for data preprocessing and GIS model runs: BOREES, SPECIES, STATUS, BREED and various look-up tables (e.g., POLY_LUT, PNTS_LUT, etc.). Key attribute fields needed for USA identification include RARNUM (unique spatial identifier linked to various attribute tables), SPECIES_ID (unique species identifier), EL_SPE (concatenation of element type and SPECIES_ID), EL_SPE_SEA (concatenation of element type, SPECIES_ID, and SEAS_ID), NAME (common name), GEN_SPEC (scientific name), and T_E (federal T&E status). For more information on NOAA ESI datasets, see http://response.restoration.noaa.gov/esi/esiintro.html.

OPS obtained a list of current Ramsar sites and site descriptions from the Ramsar Convention (http://www.ramsar.org/). OPS contacted the USFWS Office of International Affairs for maps and data on these areas. They provided a list of Ramsar site coordinators or managers for the U.S., who were in turn contacted for digital data depicting Ramsar site boundaries. OPS obtained hardcopy maps when digital data were not available directly from a Ramsar site contact. Based on the site names and hardcopy maps, OPS was able to obtain digital site boundaries for most locations from the U.S. Geological Survey (USGS) 1:100,000-scale Digital Line Graph (DLG) Boundary files. The DLG data are digital representations of points, lines, and
areas. OPS digitized hardcopy boundaries when digital boundaries were not available in the DLGs, or when hardcopy maps or site descriptions indicated additional areas not shown in the DLGs.

OPS obtained a list of current WHSRN sites and site descriptions from the Manomet Center for Conservation Sciences (http://www.manomet.org/). The coordinator of the WHSRN program at Manomet was also contacted to obtain maps, data, additional descriptions, and local site managers or contacts. OPS obtained hardcopy maps for all sites and available digital boundaries from local contacts for a few sites. Based on the site names and hardcopy maps, OPS was able to obtain site boundaries for most locations from the USGS 1:100,000-scale DLG Boundary files. OPS digitized hardcopy boundaries when digital boundaries were not available in the DLGs, or when hardcopy maps or site descriptions indicated additional areas not shown in the DLGs.

OPS obtained the hydrography (or surface water features) data from the USGS 1:100,000 scale DLGs. The DLGs contain a full range of attribute codes, have full topological structuring, and have passed certain quality-control checks described in the Federal Geographic Data Committee’s (FGDC) Content Standards for Digital Geospatial Metadata. These files were downloaded from USGS’s web site: http://edcwww.cr.usgs.gov/glis/hyper/guide/100kdlgfig/states.html.

OPS obtained state and county boundaries from the U.S. Census Bureau TIGER data files (1990 State and Equivalent Areas). These files were downloaded from http://www.census.gov/geo/www/cob/st.html. For coastal states, the shoreline portion of the state boundary was updated using the DLG hydrographic data because it was much more detailed. State waters boundaries were incorporated for coastal and Great Lakes states as well, based on data available in the DLGs or other sources. In some cases, state waters were not available digitally and had to be digitized from NOAA nautical charts or USGS maps, or generated using buffers based on boundary descriptions (e.g., state waters extend 3 nautical miles from the shoreline).

Processing the Data to Create USAs
OPS used the GIS software ArcInfo to develop the USA GIS model used in this project. The ecological USA model has several phases:

A. Prepare data for model entry;
B. Identify records meeting data quality criteria;
C. Identify records meeting candidate criteria;
D. Apply filter criteria;
E. Generate USA boundaries;
F. Final USA QA/QC, maps, and statistics; and
G. Final data preparation.

Phase 1 - Prepare Data for Model Entry
During data preparation, OPS reviews the original data that have been obtained from all sources to make sure the required data fields are present and there are no peculiarities in the data. Most of the USA ecological data comes from the ABI and the ESI datasets. If any peculiarities are identified, OPS contacts the entity that provided the data and any questions or difficulties are addressed.

For the ecological model, data from adjacent states can be accepted into the model as well. When data from adjacent states are available, OPS generates a 5-mile buffer around the state that is being processed. The ecological data contained within this 5-mile buffer is incorporated into the model and processed.

ESA Status. The USESA_EO field from the ABI dataset is initially used to populate a new field referred to as UPDATED_TE for each element occurrence. Depending on the date of the ESI datasets and the geographic area covered, T&E information from the ESI status table may also be used to populate UPDATED_TE for ESI species records. UPDATED_TE is checked, particularly for the ESI species records, as described below. A new field called DEPLETED_MM is also created for the MJD and ESI datasets. This field is updated with depleted marine mammal status, as described below.

Habitat Determination. The attributes of the ABI dataset are used to generate two spreadsheets. The first spreadsheet is a short form containing all species found in the state dataset and all element level attributes.
The second spreadsheet is a long form containing all occurrences and occurrence level attributes. Scientific staff use these forms to develop habitat, aquatic-dependency, and limited range assignments. T&E and depleted marine mammal status are also evaluated at this time. A "notes" section is completed that indicates any questions or difficulties encountered during the assignment of habitat and range, review of T&E information, etc. Source information is noted as appropriate.

The attributes of the ESI dataset(s), particularly common name, scientific name, federal status, GRANK (if available), and a unique identifier are used with the ABI dataset to generate a query that matches species from the ESI data to species tracked by the NHPS. The goal of this process is to assign ELCODEs, GRANKS, and derived EOCODEs to the ESI species ("mock" ELCODEs and EOCODEs consisting of the site name are used for Ramsar and WHSRN sites, and no GRANKS are applied). The results of this query are transformed into a spreadsheet that is reviewed by scientific staff. Automated matches are evaluated and either accepted or rejected. If rejected, a more appropriate match is selected and entered into the spreadsheet manually. Potential candidates not identified during the automated match are also evaluated and manual matches assigned as appropriate. T&E information for the ESI data are also updated at this time, and habitat and range assignments determined. In certain cases, preliminary ELCODE and/or T&E assignments are made and the spatial data reviewed in ArcView to determine final assignments based on geography (for species that can be assigned to several ELCODEs at the infra-specific level, and for species with partial T&E status based on distinct population segments, e.g. anadromous salmonids in western coastal states). A "notes" section is completed during this process that indicates any questions or difficulties encountered. Source information is also noted as appropriate.

For point data, habitat assignments are made by scientific staff based on habitat information provided by ABI with the MJ D and supplemental habitat sources mentioned above. When available information is not sufficient to make a habitat assignment, ABI is contacted to provide assistance or additional information. ABI may in turn contact the state NHP for assistance. In most cases, habitat assignments are the same for all occurrences of a species. For a few types of species, habitat types can vary by the type of occurrence. Where information is available, assignments are made at the occurrence level. This situation applies for species such as seabirds (nesting vs. feeding areas), aquatic or marine reptiles (nesting vs. adult areas), and certain amphibians (breeding/larval vs. adult areas).

Habitat assignments are used to define buffers to be drawn in creating USAs, and are limited to the following categories: Aquatic Open Water (AOW), Aquatic Isolated Water (AIW), and Terrestrial (TER). AOW habitats include open and flowing water bodies such as oceans, estuaries, lakes, ponds, pools, streams, and certain wetland types that are typically permanently flooded. AIW habitats include most wetlands, temporary or seasonal ponds and pools, seeps, beaches, bars, flats, floodplain habitats, riparian habitats and subterranean waters. These habitats are generally intermittently wet or flooded, and are often located adjacent to AOW habitats that have relatively permanent standing water or flowing water. Habitats that are described only as "moist" or "mesic" or not included in the aquatic categories, and are treated as terrestrial. All other non-aquatic habitats are treated as terrestrial as well. It is important to differentiate between AOW and AIW/TER habitats, since this determines the spatial area depicted for each USA occurrence. AOW and AIW/TER occurrences are treated differently during the generation of USA polygons, while AIW and TER occurrences are treated the same. Habitat assignments are typically consistent across states. Habitat assignments may vary where different occurrence types exist or are mapped in a state (breeding/larval vs. adult areas), where habitats associated with the occurrence differ between states (nesting on cliffs vs. wetland vegetation), or where more state-specific information is available for one state versus another (in California, species generally occurs in habitat X but in Wyoming, species is restricted to habitat Y). All habitat assignments are checked by a second biologist prior to the model runs.

Aquatic and aquatic dependent (AD) and terrestrial limited range (LR) assignments needed for Filter Criteria 5 are usually assigned at the species level. Species with occurrences classified as AOW or AIW are always assigned to the AD category. Species with occurrences classified as TER are assigned to the AD category if they are dependent on aquatic habitats during some critical portion of their life-history. As an example, occurrences for a seabird species that uses cliff or upland forest nesting sites would be classified as TER, but the species would be classified AD if its feeding areas were marine waters. Species that are not assigned to the AD category are evaluated to determine if they have a limited range. Species with a limited range have home ranges or inferred extents of no more than five (5) acres. When available information is not sufficient to
make an AD or LR determination, ABI is contacted to provide assistance or additional information. ABI may in
turn contact the state NHP for assistance as needed. Aquatic-dependency and limited range assignments are
checked by a second biologist prior to the model runs.

Precision. When the ABI dataset contains ACCURACY_CLASS or a similar spatial data quality descriptor, in
place of or in addition to PRECISION, a new precision field is created and updated to incorporate this
information. This occurs in a few states and primarily where element occurrences are represented wholly or in
part as regions or polygons. The GIS model will accept the following values in the updated precision field: G
(general, precision within five miles or to quad or place name), M (minutes, accuracy within a one-minute
radius), S (seconds, accuracy within a three-second radius), U (unmappable), 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0.
The numeric values correspond to accuracy class used in a few states: 1 and 2 represent specific-bounded
areas, 3 represents non-specific bounded areas, 4-9 and 0 (10) represent accuracy values based on radii
associated with point locations or regions/polygons generated by buffering points.

Creating Polygons. The DLG hydrography layers (polygons and arcs) are pre-processed prior to the model runs.
For the ecological model, the majority of hydrographic features are classified as “open-water”, while a few
feature types are classified as “other” hydrographic features. These hydrographic “open-water” features are
used in the model during the generation of USA polygons from point occurrences identified as ecological USAs.

Occurrences from the ABI or ESI datasets that are represented as arcs (lines) are buffered by a quarter mile to
generate polygons or regions. These are added to the existing polygon or region coverages. Unless otherwise
specified in the original datasets or metadata, these occurrences are treated as specific-bounded areas.

Phase 2 - Identify Records Meeting Data Quality Criteria
All data records are examined to determine if they meet data quality criteria. A data record is not used if it
does not meet the criteria. The first data quality criterion is spatial, pertaining to precision or accuracy and
regions or polygons vs. points. If the occurrence is a “specific-bounded area” or has a precision value of S or
M, the polygon or region is retained and any point data that corresponds to the same occurrence is omitted. If
the occurrence is not classed in this manner, the polygon or region is omitted from the model. If there is point
data corresponding to the same occurrence, it is retained for evaluation. Point data with updated precision
values of M, S, or 1-9 are retained in the model, while point occurrences with values of G, U, and 0 are
excluded. The ESI data represent “specific-bounded areas” and points with minutes are better precision unless
otherwise noted in the metadata.

The second data quality criterion removes elements or occurrences that are extirpated. For the ABI dataset,
the state conservation status (SRANK) and the EORANK are evaluated. All occurrences with an SRANK value of
SX (state extirpated) or a rounded EORANK value of X are omitted from the model. For the ESI data, all records
are considered extent unless otherwise stated in the metadata.

Phase 3 - Identify Records Meeting Candidate Criteria
Next, the model determines which occurrences or data records meet the ecological candidate USA criteria.
The model evaluates each occurrence and record to identify candidate USA resources. The model reviews the
values found in the ROUNDEDGRANK, UPDATED_TE, and DEPLETED_MM fields. Occurrences with any of the
following are considered candidates: ROUNDEDGRANK = G1, G2, T1, or T2; UPDATED_TE = LE, LT, XE, or XN
(listed endangered, listed threatened, essential experimental population, or experimental nonessential
population, respectively); or DEPLETED_MM = Y. The model treats all Ramsar and WHSRN sites as candidates.
The model retains candidate resources for consideration as USAs. Resources not identified as candidates are
omitted.

Phase 4 - Apply Filter Criteria
Under Filter Criteria 1, all critically imperiled candidates are USAs. These are identified by a GRANK value of
G1 or T1.

The model moves to Filter Criteria 3 next, migratory waterbird concentration areas, where all Ramsar sites are
identified as USAs. WHSRN sites are then evaluated and sites classified as hemispheric, international, and
endangered species reserves are identified as USAs. Regional WHSRN sites are not considered USAs, but are retained for evaluation under Filter Criteria 2.

Filter Criteria 4 evaluates the viability of the species. Within the ABI dataset, all occurrences with rounded EORANK values of A or B are identified as USAs. The ESI data are not evaluated unless EORANK values are provided in the ESI datasets and described and defined in the metadata.

Filter Criteria 5 evaluates if the occurrence is aquatic, aquatic dependent, or terrestrial with a limited range. All occurrences with Y values in either the AQUATIC_DEPENDENT or RANGE fields are identified as USA resources.

Filter Criteria 2 is the final filter criteria evaluated by the model. Under Filter Criteria 2, the model generates 1-mile buffers around all candidate data points. Data represented as polygons or regions are evaluated using their existing boundaries. Next, the GIS model evaluates whether the candidate area is overlapped by at least two resources of a different type (different species, ecological communities, or migratory waterbird sites). The ELCODE is used to identify different resource types. Each occurrence or record that contributes to a combination of three or more overlapping resource types is identified as a USA resource in its entirety. Note that data from adjacent states that are included in the model run can interact with data from the state being processed to create Filter Criteria 2 USAs.

Phase 5 - Generate USA Boundaries

Occurrences or data records identified as USAs and represented as polygons or regions in the original data (or arcs converted to polygons or regions) retain their original or generated boundaries. Point occurrences or data records identified as USAs receive derived boundaries based on habitat assignment, a pre-determined buffer distance, and in the case of AOW species, overlap with hydrography features. USAs for point occurrences assigned to either the AIW or TERR categories are defined by a model-generated 1-mile buffer around the point. USAs for point occurrences assigned to the AOW category are generated by the model selection of all polygonal and linear "open-water" hydrographic features falling within a 5-mile buffer around the point. In addition to the selected features, the model generates 1/4-mile buffers along all "land/open-water" interface boundaries within the 5-mile buffer. The AOW USAs are thus defined as all hydrographic features classed as "open water" plus a 1/4-mile buffer falling within a 5-mile radius of the original point.

Phase 6 - Final USA QA/QC, Maps, and Statistics

After the model run, a draft version of the final USAs and interim coverages generated by the model are reviewed by scientific and GIS staff. An ArcView project generated by scientific staff is used to check the model output by evaluating all steps in the process described above. GIS staff members perform several routine checks on the data as well using ArcInfo and ArcView. Once the final USAs are approved, a map is produced for each state using a standardized layout and statistics are generated. Currently, statistics include calculating the percentage of state occupied by ecological USAs.

Phase 7 - Final Data Preparation

During the model run several new items are generated and associated with the USA resources and polygons: FILTER, SOURCE, and ECOUNIQUE_ID. Filter is populated with information indicating which filter criteria created the USA. Source refers to the original source of each data record that became a USA. Source is generated by the model using information contained in the EOCODE field. An example of a source value would be "LANHP", referring to the Louisiana Natural Heritage Program. ECOUNIQUE_ID is a unique identifier for each ecological USA, generated using EOCODE, but containing no specific information about the USA (taxonomy, status, source, etc. cannot be determined using this identifier alone). Final ecological USAs are converted regions and dissolved on ECOUNIQUE_ID. The only attributes on the final USAs are ECOUNIQUE_ID and SOURCE. The actual identities of the USAs can only be determined using a reference table that is generated to link ECOUNIQUE_ID to EOCODE. This table is provided only to OPS, ABI and the state NHPs.

Creation of USA Maps

The final USA maps are placed on OPS’s National Pipeline Mapping System (http://www.npms.rspa.dot.gov) to allow pipeline operators and others to view USAs in relation to pipelines and other resources. OPS has begun to create USA maps for all 50 states. The National Pipeline Mapping System allows individuals to “zoom” and “pan” to the area(s) of interest and turn USA and other data layers “on” and “off” depending on their needs.
Additional data layers are also available, such as pipeline locations, populated areas, and high-hazard natural disaster areas. Individuals have the ability to print maps or download data representing high population areas, navigable waterways, pipelines, drinking water USA's, and other data layers to their local machines for use in their own GIS maps. Ecological USA data are proprietary and can not be downloaded. As of September 2001, OPS has completed identifying and mapping ecological USAs in over half of the states and expects to finish all 50 states by February 2001.

**Development and Provision of Ecological Data**

As described above, ABI generated the majority of ecological data used to create USAs. This section describes ABI, the Natural heritage Network and Natural Heritage Data Methodology.

**Roles of the Association for Biodiversity Information and the Natural Heritage Network**

ABI is a non-profit organization working in partnership with the network of Natural Heritage Programs (NHPs) to gather, organize, and distribute high-quality biodiversity information. ABI builds upon work begun by The Nature Conservancy, America’s largest environmental nonprofit organization, which began forming state NHPs over 25 years ago. The Nature Conservancy worked with state and federal agencies to establish NHPs in each state and make biodiversity information available. Each state program is independent and typically operated by a state agency with responsibilities for wildlife, natural area, or natural resource management.

As the NHPs matured, the need for network-wide collaboration and cooperation grew and led to ABI’s establishment. ABI is now an independent, non-profit organization devoted to supporting and representing the needs and interests of NHPs and CDCs throughout the hemisphere. The organization has an active role in planning future heritage inventory efforts, creating the institutional framework for broader network-wide coordination, and helps to support the on-going efforts to catalogue our nation’s biological riches.

**Role of Natural Heritage Programs**

In its most basic terms, NHPs are involved in three distinct activities:

- gathering information, through documenting existing knowledge and carrying out new inventory and research work;
- organizing, analyzing, managing, and updating this information by using structured methods and standard database and mapping procedures; and
- distributing information and knowledge, through sharing data and providing products and services to users.

But how are determinations made as to what data should be gathered, and how it should be organized?

**Data Collected by the Natural Heritage Programs**

A NHP’s primary function is to fill the information void for those species that are of greatest significance from a conservation perspective. As discussed previously, rare species are in need of specific inventory and targeting for two reasons. First, by their very nature they are not uniformly distributed across the landscape and tend to be very localized. Second, their rarity confers an inherently greater risk of extinction and consequently they become of particular interest to those devoted to “saving all the pieces.”

NHPs gather data designed to address a series of basic questions important to carrying out biodiversity conservation efforts. What species and ecological communities exist in the area of interest? Which are at greatest risk of extinction, or are otherwise significant from a conservation perspective? What are their biological and ecological characteristics, and where precisely are these priority elements found? What is their condition at those locations, and what processes or activities are sustaining or threatening them? Where are the most important sites to protect? Who owns or manages those places deemed important to protect and what is threatening these places? What actions are needed for the protection of those places and the significant elements of biodiversity they contain? And how can we measure our progress towards conservation goals?

The biological information important for species-level work are basic taxonomy, general species distributions, the locations of priority taxa, their relative rarity or abundance, population trends, ecological relationships, and
habitat requirements. Information useful for ecosystem- and natural community-level work includes vegetation structure and composition, key environmental factors, successional status, disturbance regimes, and the spatial distribution and integrity of communities across the landscape.

Key to the functioning of NHPs is the concept of setting priorities for information gathering and inventory. The number of possible facts and observations that can be gathered about the natural world is essentially limitless. The financial and human resources available to gather such information are not. Therefore, there is a premium on devising systems that are both effective in providing information meeting users’ needs, and efficient in the manner by which that information is gathered. Most NHPs use a Conservation Ranking System to achieve these twin objectives of effectiveness and efficiency. In an effort to balance global and local conservation concerns, global, national, and subnational (provincial or state) ranks are used to select the elements which should receive priority for research and conservation by a NHP.

Ranking species and ecological communities according to their conservation status provides a means to apply a “coarse filter/fine filter” approach to conservation. Using these rankings, a state NHP can keep track of the entire suite of species within its jurisdiction—the rare and the common—but target intensive information gathering and inventory efforts towards those highly ranked species that require concerted conservation attention. NHPs have developed tools for applying an ecological filter to define and identify particular ecological communities occurring within their states and assess the extent and status of each.

Before any new field inventories are carried out in search of a particular target species or ecological community, all available knowledge about that element is gathered, organized, and mapped. This process relies on many different secondary sources of information, including museum collections, primary scientific literature, “gray literature,” and interviews with knowledgeable biologists. In many instances, simply compiling what already is known about a species is enough to demonstrate that it is more common than previously thought, and not in immediate need of either additional inventory work or specific protection measures. When this is not the case, the process of exhaustively compiling existing data helps define where and when heritage biologists and their collaborators should carry out field work to seek out new populations, or to revisit existing populations and assess their current condition.

Data Organization by the Natural Heritage Program. A distinguishing feature of the heritage effort is the close attention to the details of organizing and managing the voluminous data being gathered. The NHPs have constituted an on-going and dynamic inventory process from the beginning. The NHP network developed software tools to codify the standards and protocols by which the network operates and have promoted the consistent application of these methods. The use of consistent information management tools has greatly facilitated the ability to compare and aggregate data across states, as has been done in the production of USAs.

Role of the Association for Biodiversity Information
The NHPs are designed to function in a decentralized fashion, with local programs responsible for their own data holdings. Information about basic species taxonomy, life history characteristics, and rangewide distribution are needed across the network but it would be inefficient for each program to develop and manage such information independently. Further, global or rangewide assessments of species status frequently transcend the bounds of single states, so it is necessary to manage this information centrally. ABI’s Natural Heritage Central Databases provide this hub function for the heritage network, maintaining global and national-level information that pertains broadly to species and ecological communities. Through a data exchange process, state programs periodically provide summaries of state-level information to the central databases (for instance state conservation status) and receive the most current global level information for species and communities in their jurisdiction.

Description of Natural Heritage Data Methodology
The goal of documenting and mapping rare or otherwise at-risk species has a practical implication. To be useful for on-the-ground conservation and environmental planning such species must be mapped at a very precise level of detail. If the alignment of a road is at stake, a builders’ permit is in jeopardy, or the requirements of the pipeline safety standard will be triggered, one must be able to identify with exactitude where the sensitive resources occur. For these types of real world applications merely knowing the general
vicinity is not enough. For the rarest of the rare, mapping at a fine scale of resolution is essential. It becomes possible to attempt not just a statistical sample of the species, but an actual census—that is a complete enumeration of the species’ populations.

The Natural Heritage Programs function to inventory each state or subnation (e.g. Navajo Nation) for biological features in need of conservation attention (Jenkins 1985, 1988, 1996). Because these features may include more than just the locations of individual species, the inclusive phrase ‘elements of natural diversity’ was put into use with the creation of the first NHP in 1974. The concept and term ‘element’ still remains in use today. A strength of the ABI dataset is the consistent use of Natural Heritage Data methodology used by its member NHPs.

An element is defined as a unit of natural biological diversity, representing species (or infraspecies taxa), ecological communities, or other non-taxonomic biological entities, such as migratory species aggregation areas. For the purposes of the ecological USA map, these elements of diversity refer to the locations of species and infrataxa only. No ecological communities were included in the datasets provided.

Assigning Conservation Status Ranks

An element is assigned one global rank (called a GRANK), which applies across its entire range; a national rank (NRANK) for each nation in its range; and a subnational rank (SRANK) for each state, province, or other subnational jurisdiction in its range. In general, ABI scientists assign global ranks and U.S. and Canadian national ranks. These scientists receive guidance from subnational data centers, especially for endemic elements, and from experts on particular taxonomic groups. Local data centers assign subnational ranks for elements in their respective jurisdictions and contribute information for national and global ranks. New information provided by field surveys, monitoring activities, consultation, and literature review improves accuracy and keeps ranks current. ABI’s centrally aggregated data are stored in the Natural Heritage Central Databases. These databases are updated continually with revisions, corrections, and information on ranked elements. Species’ conservation status ranks are updated annually in the data exchange process between local data centers and ABI’s central office.

What the Ranks Mean. The conservation rank of an element known or assumed to exist within a jurisdiction is designated by a whole number from 1 to 5, preceded by a G (Global), N (National), or S (Subnational) as appropriate. G1, for example, indicates critical imperilment on a range-wide basis—that is, a great risk of extinction. S1 indicates critical imperilment within a particular state, province, or other subnational jurisdiction—i.e., a great risk of extirpation of the element from that subnation, regardless of its status elsewhere. Species known in an area only from historical records are ranked as either H (possibly extirpated/possibly extinct) or X (presumed extirpated/presumed extinct). Certain other codes, rank variants, and qualifiers are also allowed in order to add information about the element or indicate uncertainty. The global ranks are defined in Table 1 below.
<table>
<thead>
<tr>
<th>Rank</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>GX</td>
<td>Presumed Extinct (species)—Believed to be extinct throughout its range. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.</td>
</tr>
<tr>
<td>GH</td>
<td>Possibly Extinct (species)—Known from only historical occurrences, but may nevertheless still be extant; further searching needed.</td>
</tr>
<tr>
<td>G1</td>
<td>Critically Imperiled—Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 5 or fewer occurrences or very few remaining individuals (&lt;1,000) or acres (&lt;2,000) or linear miles (&lt;10).</td>
</tr>
<tr>
<td>G2</td>
<td>Imperiled—Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction or elimination. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or linear miles (10 to 50).</td>
</tr>
<tr>
<td>G3</td>
<td>Vulnerable—Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction or elimination. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.</td>
</tr>
<tr>
<td>G4</td>
<td>Apparently Secure—Uncommon but not rare (although it may be rare in parts of its range, particularly on the periphery), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.</td>
</tr>
<tr>
<td>G5</td>
<td>Secure—Common, widespread, and abundant (although it may be rare in parts of its range, particularly on the periphery). Not vulnerable in most of its range. Typically with considerably more than 100 occurrences and more than 10,000 individuals.</td>
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<tr>
<th>Variant Global Ranks</th>
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<tr>
<td>G#G# Range Rank—A numeric range rank (e.g., G2G3) is used to indicate uncertainty about the exact status of a taxon. Ranges cannot skip more than one rank (e.g., GU should be used rather than G1G4).</td>
</tr>
<tr>
<td>GU Unrankable—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. NOTE: Whenever possible, the most likely rank is assigned and the question mark qualifier is added (e.g., G2?) to express uncertainty, or a range rank (e.g., G2G3) is used to delineate the limits (range) of uncertainty.</td>
</tr>
<tr>
<td>G? Unranked—Global rank not yet assessed.</td>
</tr>
<tr>
<td>HYB Hybrid—(species elements only) Element not ranked because it represents an interspecific hybrid and not a species. (Note, however, that hybrid-derived species are ranked as species, not as hybrids.)</td>
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<table>
<thead>
<tr>
<th>Rank Qualifiers</th>
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</thead>
<tbody>
<tr>
<td>? Inexact Numeric Rank—Denotes inexact numeric rank</td>
</tr>
<tr>
<td>Q Questionable taxonomy that may reduce conservation priority. Distinctiveness of this entity as a taxon at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority (numerically higher) conservation status rank.</td>
</tr>
<tr>
<td>C Captive or Cultivated Only—Taxon at present is extant only in captivity or cultivation, or as a reintroduced population not yet established.</td>
</tr>
</tbody>
</table>

Ranking Factors. Use of standard ranking criteria and definitions makes Natural Heritage ranks comparable across element groups—thus G1 has the same basic meaning whether applied to a salamander, a moss, or a forest community. Standardization also makes ranks comparable across jurisdictions, which in turn allows ABI scientists to use the national and subnational ranks assigned by local data centers to determine and refine or reaffirm global ranks.

Ranking is a qualitative process - it takes into account several factors, which function as guidelines rather than arithmetic rules. The ranker's overall knowledge of the element allows him or her to weigh each factor in
relation to the others and to consider all pertinent information for a particular element. The factors considered in ranking species and communities are similar, but the relative weight given to the factors differs.

For species elements, the following factors are considered in assigning a rank:

- total number and condition of element occurrences
- population size
- range extent and area of occupancy
- short- and long-term trends in the foregoing factors
- threats
- environmental specificity
- fragility

Element Occurrence Data and Ranking

Given the focus of NHPs on documenting patterns of biodiversity, mapping the distribution of species, ecological communities, and land units is central to their work. A variety of mapping tools and techniques are employed to record spatial features with accuracy and precision. Undoubtedly the most important geographic feature that NHPs map is the element occurrence (EO). An element occurrence depicts the geographic location for a species population or ecological community. Formally defined as "an area of land and/or water in which a species or natural community is, or was, present," an element occurrence ideally reflects species population units; either a distinct population, part of a population (subpopulation), or a group of populations (metapopulation). These occurrences constitute the principal source of detailed information about the distribution of rare or imperiled species and ecological communities, and are the most widely used type of information gathered and managed by NHPs.

Applying this concept across a wide array of organisms and ecological types raises issues of consistency. What might constitute an appropriate area measure for a highly mobile bird species, may be quite different from that needed for a firmly rooted tree species. For this reason, element-specific definitions are essential for determining what constitutes a valid "occurrence" and is therefore appropriate to map. These definitions are embodied in element occurrence specifications, which are developed on a species-by-species and community-by-community basis, and which become part of the permanent heritage computer registry for any given species or community.

Specifications for a particular organism might include the minimum required size of population or habitat area needed to sustain or contribute to that species’ survival. To help differentiate and delineate distinct occurrences, total barriers to dispersal as well as distances sufficient to impede between population movements are factored into these specifications. To a bog turtle (Clemmys muhlenbergii), for example, a four-lane divided highway may represent a complete barrier to movement, while dams exceeding 20 feet in height may similarly restrict the movement of salmon. Appropriate separation distances may depend on a variety of factors, such as the species’ dispersal ability, home range size, and spatial and temporal patterns, but as a general guideline, one kilometer is the minimum recommended separation distance for defining two distinct occurrences.

Once the location of the element is determined and delineated based on the biology of the species, the quality or viability of each occurrence is assessed in the form of an element occurrence rank (EORANK). In general, EO ranks are designed to represent the relative conservation value of an occurrence and are assigned on the basis of the population’s size, condition and landscape context. The EORANK is a code which represents a comparative evaluation of the EO summarizing quality, condition, viability, and defensibility range-wide. If the rank is not known, the field is left blank.

It is important to note that EORANK is considered a “supplemental” field and is not developed by all NHPs as a high-priority field. Consequently, EORANKs are not provided by all state NHPs. In those programs that use EORANKs, the use of EORANK is not yet standardized and well-coordinated between NHPs nor have all Eos been assigned an EORANK within some states. Due to the “uneven” quality of the EORANK data, it should be used in a supplemental manner, and not compare Eos across state borders.
Element Occurrence Rank Values. The EORANK, used in Filter Criteria 4, represents a comparative evaluation based on recent field work by a knowledgeable individual and summarizes several factors including:

- **Quality** - how representative the occurrence is, especially as compared to element occurrence specifications and including maturity, size, numbers, etc.;
- **Condition** - how much has the site and the element occurrence itself been damaged or altered from its optimal condition and character;
- **Viability** - the long-term prospects for continued existence of the occurrence; and
- **Defensibility** - the extent to which the occurrence can be protected from extrinsic human factors that might otherwise degrade or destroy it.

The best occurrence of an Element in a particular state is not necessarily assigned an "A" rank; it may be assigned a "B", "C", or "D" rank, if somewhere else in the Element's global range, there are occurrences that merit a higher rank. EORANKS are defined in Table 2.

<table>
<thead>
<tr>
<th>EORANK</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Excellent</td>
</tr>
<tr>
<td>B</td>
<td>Good</td>
</tr>
<tr>
<td>C</td>
<td>Marginal</td>
</tr>
<tr>
<td>D</td>
<td>Poor</td>
</tr>
<tr>
<td>X</td>
<td>Extirpated</td>
</tr>
<tr>
<td>H</td>
<td>Historical</td>
</tr>
<tr>
<td>O</td>
<td>Obscure</td>
</tr>
<tr>
<td>E</td>
<td>Extant (present)</td>
</tr>
<tr>
<td>_I</td>
<td>Introduced (used only as a qualifier of the ranks above)</td>
</tr>
</tbody>
</table>

A slash may be added to a 2- or 3-letter code combination making a 3- or 4-character code (e.g. "A/B" or "A/B/I") without changing the significance of the slash-less code.

Rounded Element Occurrence Rank. The rounded element occurrence ranks represent the "basic ranks" described in the EORANK field definition above and are intended to simplify complex element occurrence rank values for use in analyses. Rounded ranks serve as an approximate substitute only; they are not intended as a replacement for the detailed information contained in the actual EORANK fields. The rounded element occurrence ranks are generated by a calculated field, EORANK.ROUND.

Description of ABI Dataset

The following description summarizes the information found in each of the state datasets from ABI delivered to DOT. The completeness of ABI's data varies between species. ABI's data is particularly strong and very complete in tracking the terrestrial and freshwater vertebrate species, vascular plants and entities with federal status under the Endangered Species Act (ESA). Many invertebrate groups are completely tracked, but the databases on these elements continue to expand. The non-vascular plant data (lichens, mosses, liverworts & hornworts, fungi) is being actively developed and element occurrences of these groups will expand over the next few years. Marine species, even in coastal areas are not completely tracked and documented with element occurrences, however this varies across NHPs.

Data Quality

All the data fields which are considered necessary to create the ecological USA maps were quality controlled either by the individual NHP or ABI staff to meet minimum standards for spatial representation, taxonomy and status as defined below:

- **Conservation Status Ranks:** ABI has conducted quality control checks to assure that the global conservation status ranks of the individual state datasets are consistent with the most current ranks in the Natural Heritage Central Databases.
• **Federal Status Designations:** ABI has conducted quality control checks to assure that the federal listed status for each species and element occurrence correlates with the most recent U.S. Fish and Wildlife Service listing of Threatened and Endangered species. Where species have a partial or mixed federal status designation, the correct federal status has been assigned at the element occurrence level and only those occurrence records that are federally listed have been provided.

• **Spatial Data:** All element occurrence records are mapped as accurately as recorded by NHPs with at least a General precision. Any element occurrences known to be incorrectly identified or mapped have been excluded.

Data Field Definitions

Included below in Table 3 are definitions for fields provided in the master list of species and in the state-by-state EO datasets from ABI.

Table 3

Data Fields Provided by ABI

<table>
<thead>
<tr>
<th>Field</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Master List of Rare or Federally Listed Species</strong></td>
<td></td>
</tr>
<tr>
<td>ELCODE</td>
<td>A unique identifier for the taxa assigned by the ABI central database staff. It can be used to create relationships between all data provided.</td>
</tr>
<tr>
<td>GNAME</td>
<td>The standard global (i.e. range-wide) scientific name (binomial nomenclature) adopted for use in the Natural Heritage Central Databases based on standard taxonomic references.</td>
</tr>
<tr>
<td>GCOMNAME</td>
<td>The standard global (i.e. range-wide) common name adopted for use in the ABI Central Databases.</td>
</tr>
<tr>
<td>GRANK</td>
<td>The conservation status of a species from a global (i.e. range-wide) perspective, characterizing the relative rarity or imperilment of the species.</td>
</tr>
<tr>
<td>GRANKDATE</td>
<td>The date the Global Conservation Status Rank of an element was last reviewed and updated by ABI scientists.</td>
</tr>
<tr>
<td>ROUNDED.GRANK</td>
<td>A rounding algorithm has been applied to the conservation status rank to systematically produce conservation status values which are easier to interpret and summarize.</td>
</tr>
<tr>
<td>USESADATE</td>
<td>The date of publication in the Federal Register of notification of an official status for a taxon or population. Dates appear only for taxa and populations which are specifically named under the U.S. Endangered Species Act.</td>
</tr>
<tr>
<td>STATE.SNAME</td>
<td>The standard state scientific name adopted for use by the state / subnation NHP based on selected taxonomic references used by the state. These are usually previously published state floras or faunas.</td>
</tr>
<tr>
<td>STATE.SCOMNAME</td>
<td>The state common name of species adopted for use by the state / subnation NHP.</td>
</tr>
<tr>
<td>TAX.NONSTD</td>
<td>For plant records only, identifies taxa which are not based on the standard taxonomic references used by the ABI central database staff.</td>
</tr>
<tr>
<td>GHABCOM</td>
<td>A text summary of the habitats and microhabitats commonly used range-wide describing any daily, seasonal, and geographic variation in habitat use.</td>
</tr>
<tr>
<td>ALL.HAB.TYPES</td>
<td>For animal records only, a text field that combines the values from several fields which characterize habitat at a global or range-wide level. These values are selected from a set of standardized “drop down” lists.</td>
</tr>
</tbody>
</table>

**Additional Fields Specific to Each State Element Occurrence Sets**

<table>
<thead>
<tr>
<th>Field</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOCODE</td>
<td>A unique record identifier for each element occurrence. This code consists of: ELCODE<em>EONUM</em>STATE where EONUM is a counter used to identify unique occurrences and STATE is the state in which the occurrence is located.</td>
</tr>
<tr>
<td>LATITUDE</td>
<td>The Y coordinate of the element occurrence centrum, expressed in decimal degrees.</td>
</tr>
<tr>
<td>LONGITUDE</td>
<td>The X coordinate of the element occurrence centrum, expressed in decimal degrees.</td>
</tr>
</tbody>
</table>
Field | Definition
--- | ---
USESA-EO | Federal Status as assigned under the Endangered Species Act at the EO level to accommodate species with varying status across their range.

PRECISION | A code for EO mapping precision. Primary values: S = seconds: accuracy within a three second radius, M = minutes: accuracy within a one-minute radius, G = general: precision within 8 kilometers, 5 miles, or to quad or place name, and U = unmappable. Any additional values will be included in documentation for each state.

LASTOBS | The date the element occurrence was last observed to be extant at the site.

State Datasets Also Include the Following Data Fields as Available

SRANK | The conservation status of a species from the state/subnation perspective, characterizing the relative rarity or imperilment of the species.

SPROT | Abbreviation used by state/subnation for the level of legal protection afforded to the element by that entity. Abbreviations will vary by state or subnation.

EOTYPE* | A descriptive term used to categorize the type of location where a species is found. Used primarily for animals (especially migratory species), common EO types include: breeding site, wintering site, roosting area, staging area, bachelor colony, hibernaculum, nursery colony, communal use site.

EODATA* | Data collected on the biology of the EO, which may include the number of individuals, vigor, habitat, soils, associated species, particular characteristics, etc.

EORANK* | A code which represents a comparative evaluation of the element occurrence summarizing quality, condition, viability, and defensibility.

EORANK.ROUND* | An algorithm has been applied to the element occurrence rank to systematically produce values which are easier to interpret and summarize.

COUNTYCODE | A six digit code indicating the county in which the EO is located. If the element occurrence spans more than one county, the code for the centrum county is listed first.

COUNTYNAME | The official full name for the county designated in the COUNTYCODE field.

FIPS_CODE | A numerical code assigned by the U.S. government to uniquely identify each state and county in the country.

WATERSHED | The 8-digit code from the U.S. Geological Survey Hydrologic Unit Map for each watershed where the EO is located. If the EO spans more than one watershed, the code for the centrum watershed is listed first.

SURVEYDATE* | The date of the most recent field survey. If the species was found, the LASTOBS field will also be changed. Otherwise the SURVEYDATE serves as a means to identify negative survey results.

FIRSTOBS* | The date the element occurrence was first reported at the location with the same precision as the current EO has been mapped.

* - Fields are defined as:
- Data not standardized between states
- Data provided “as is,” data in some of these fields have not been systematically reviewed by ABI and thus should be used in a supplemental manner.

Biographical Sketches: Christina Sames is a Senior Petroleum Engineer for the U. S. Department of Transportation's Office of Pipeline Safety. She is leading the effort to identify, locate, and map unusually sensitive drinking water and ecological areas and to incorporate these areas into the National Pipeline Mapping System. Other efforts include working with pipeline operators and local officials on pipeline communications, pipeline research and development, and the national pipeline mapping system. Ms. Sames has a B.S. in Petroleum and Natural Engineering from The Pennsylvania State University.

Dennis Fink is a project manager within the Heritage Data Services Department of the Association for Biodiversity Information. An environmental engineer by training, his current work focuses on the aggregation and use of Natural Heritage data to make biological and ecological information more accessible to environmental decision makers. Mr. Fink has a B.S. in Civil and Environmental Engineering from Duke University and a M.S. in Environmental Engineering from University of California at Davis.
References


INNOVATIVE IMPLEMENTATION OF THE ENDANGERED SPECIES ACT
TO IMPROVE WILDLIFE PASSAGE

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Abstract

U. S. Highway 12 is a major highway located in North Central Idaho. It bisects a primitive, remote area of the Clearwater National Forest and is adjacent to the Selway-Bitterroot Wilderness. Habitat in this area supports a wide variety of species including fisher, bobcat, cougar, wolverine, elk, moose, deer, as well as gray wolf and lynx, which are endangered. At least five major highway improvement or enhancement projects are planned over the next two years. These projects include the construction of a year-round rest area with a National Forest Visitor Center and two miles of passing lane construction near Lolo Pass. These projects will have an impact on wildlife and habitat especially the species listed under the Endangered Species Act (ESA) the lynx and the gray wolf.

During the process of ESA Section 7 consultation, it was determined that there was insufficient site-specific information available to meet the objectives, standards, and guidelines described in the Lynx Conservation Strategy and Assessment or to make specific recommendations for project mitigation and conservation measures. Therefore, only a jeopardy call could be made which would have resulted in the visitor center and the passing lane projects not being built.

An interagency decision and agreement was made to proceed with project implementation using a unique adaptive management approach where site-specific on-the-ground wildlife data would be collected over a five-year period accessing project impacts and affects. As a result the U.S. Fish and Wildlife Service was able to reach a may effect not likely to adversely effect determination. This is the only example that we know of where a project was allowed to go ahead in this manner.

Science based mitigation measures will be recommended and implemented when appropriate. The project is a unique partnership between a variety of State and Federal Agencies. This presentation will describes the process that developed the interagency agreement, the specific wildlife data that will be collected, and how these data will be used to develop site-specific mitigation and conservation measures.
LONG-RANGE MULTI-SPECIES ADVANCE MITIGATION: CDOT'S SHORTGRASS PRAIRIE INITIATIVE PROCESS AND BENEFITS

Marie Venner, Natural Resources Unit Manager, Colorado Department of Transportation, 1603 W. Canal Court, Littleton, CO 80120. Phone: 303-798-5333. E-mail: nretap@mindspring.com

Abstract: In January 2000, the Colorado Department of Transportation, Colorado Department of Natural Resources Division of Wildlife, the Federal Highway Administration, and the Fish and Wildlife Service (FWS) and partners at public and private resource organizations came together to design an alternative way to address species impacts in the eastern third of the state, on the central shortgrass prairie. Previously consultations on listed and proposed species had been very time-consuming for all the agencies involved, without yielding noticeable benefits for the species, particularly in the case of “no-effect” and “may effect-not likely to adversely affect” decisions. At the same time, Colorado was facing increasing listings in the shortgrass prairie, including some very widespread species with the likelihood to have large economic impacts. A process leading to a programmatic agreement among the agencies was developed to deal with the driving issues detailed below and produce benefits for the environment and proactively recover and avoid federal listing of a large number of declining species.

The Shortgrass Prairie Initiative provides programmatic clearance for CDOT activities on the existing road network in the eastern third of Colorado for the next 20 years, addresses three listed and over 20 declining species with the greatest likelihood of being listed, and covers 90,000 acres of right-of-way in four of CDOT’s six regions. As part of this initiative, the FWS, FHWA, and CDOT are investing resources that would otherwise be spent a project-by-project clearance process in more comprehensive and proactive species conservation. Methodologically, the project focused on impacts to habitats rather than species individuals and estimates potential impacts using best available data in GIS, supplemented by expert opinion. The resulting project offers programmatic clearance with 1:1 habitat conservation, greater predictability in project timelines, cost savings in several categories, and more effective habitat/species preservation. The project’s uniqueness stems from its primary focus on declining rather than listed species, coverage of major as well as minor projects, and the scale at which conservation is being pursued, including planned preservation of over 20,000 acres over the next two years.

Driving Issues and Opportunities
CDOT’s Shortgrass Prairie Initiative emerged from common understandings of the problem at hand, a shared commitment to species recovery and environmental stewardship, opportunities presented by ready analyses of priority conservation areas across the central shortgrass prairie ecosystem, and willingness among the partners to utilize all regulatory flexibility to undertake a new approach to conservation and streamlining.

Drivers

Species in Peril and an Ecosystem in Decline
The central shortgrass prairie ecoregion encompasses approximately 90,700 square miles of rolling plains and tablelands dissected by streams, canyons, badlands and buttes in seven states, from southeastern Wyoming and southwestern Nebraska to northeastern New Mexico, northern Texas and northwestern Oklahoma. The ecoregion is dominated by shortgrass, mixed-grass and sand sage prairie, of which approximately 90 percent is privately owned. Grasslands are considered to be one of the most imperiled ecosystem types in North America and worldwide; Samson and Knopf wrote in 1994 that “in the larger context of conserving biological diversity in agricultural and natural ecosystems in North America, prairies are a priority, perhaps the highest priority.” At least 50 percent of the endemic grassland birds are exhibiting significant declines in numbers over large parts of their range; as a result, grassland birds have shown steeper, more consistent, and more geographically widespread declines than any other behavioral or ecological grouping of North American species. Bison, once the most significant herbivore on the Plains, has been largely extirpated from the ecoregion. The black-tailed prairie dog, the second most important herbivore on the western Great Plains, has significantly declined since the turn of this century. The black-footed ferret (Mustela nigripes) is now considered the rarest mammal in North America. In all, the ecoregion contains 54 known species considered globally imperiled by state Natural Heritage Programs. Of these, 10 species are listed as threatened or endangered, one species is proposed for listing, and six are candidates for listing as threatened or endangered under the federal Endangered Species Act; another 58 species are endemic, declining, or disjunct in the ecoregion.
The Results of NLAAs under a Project-by-Project Approach

The professionals involved in the Endangered Species Act (ESA) section 7 consultation process at FWS, FHWA, and CDOT shared an observation that the project-by-project process frequently involved a great deal of time and resources, often to less benefit than desired for the species involved. Specialists and engineers work hard to minimize project effects so that a “no effect,” or more often a “may affect—not likely to adversely affect” conclusion is possible; however, accumulated MA-NLAAs often do little to assist the species in question, which may continue to decline. Addressing species’ needs on a project-by-project basis can yield scattered and fragmented habitat conservation or improvement, contributing little to the viability of individual species and the habitats and ecosystems on which those species depend. Habitat impacts are more effectively addressed by mitigation off-site, when opportunities exist and when on-site habitats may be degraded. Analysis of rangewide species needs and allocation of mitigation dollars to those highest priorities and bottlenecks can yield greater benefits to listed species, associated declining species, and their habitats.

Rising Listings, Staffing Demands, Project and Land Costs

Rising listings, increased staffing demands and the complexity of projects with impacts to widespread threatened or endangered species have become highly visible components of an environmental regulatory process that is often blamed for project delays. As listings have expanded with the population and development in the state, CDOT has expanded staffing in order to spend an increasing amount of time clearing projects—researching species potential to occur at a given site, performing site visits, conducting or contracting out habitat assessments or surveys, drafting Biological Assessments for FWS Opinions, and developing mitigation plans. The cost of one project delay or temporary shutdown can equal the costs of mitigation for a large number of projects. To cope with the requirements for scoping, evaluation, and documentation of impacts for more and more species, CDOT decided that creating ways to streamline the regulatory process in project development was more important than ever. With project costs increasing at an average rate of six percent annually, redesign costs time and money and headaches. Potential project shutdowns, with the contractor already on-site, have even more implications. Though the cost of a potential project shut down is difficult to estimate due to the large number of factors involved, CDOT asked: what is the cost of one project shutdown over 20 years or multiple project shutdowns over 20 years?

Land costs in Colorado are also escalating rapidly. Prices in remote areas of Colorado’s Eastern Plains have risen over 50 percent annually for the past three years over 100 percent annually in many cases. As land was least expensive and unique conservation opportunities existed for prairie dog complexes in the southeastern portion of the state (CDOT Region 2), conservation efforts focused in that area. In one example, a ranch on the New Mexico/Colorado border going for $65/acre in 1996 went for $220/acre by 2000. In another case, adjacent ranches in a conservation target area that sold for $100/acre in 1997 went for $250/acre in 2001.

Land prices on the exurban fringe (Region 4) along the Front Range started at a higher level and have also risen steeply, increasing the costs of mitigation adjacent to the right of way. Limits on water in more remote counties are likely to hinder upward movement of prices for agricultural land in the longer term; these and other factors will make a linear projection inaccurate. However, a conservative projection based on CDOT right-of-way’s expected land price increases of four to ten percent annually in remote rural areas, taking into consideration limited water and development potential, still led CDOT to estimate that mitigation costs could double in the next five years, especially considering recent price increases that were larger than anticipated.

Listing Threats and Species with Potential for Widespread Impact

Of particular interest in Colorado is the black-tailed prairie dog, described as a “noxious rodent pest” under Colorado state law and regularly exterminated by farmers, ranchers, and increasingly, developers including CDOT. Following a listing petition in 1998 by the National Wildlife Federation, the FWS concluded that the black-tailed prairie dog was “warranted but precluded,” but warned state resource agencies that without a concerted and successful conservation effort, the species would be listed.

The black-tailed prairie dog is one of five prairie dog species in North America, of which two were already listed (Utah, listed as a threatened species in 1973) and the Mexican prairie dogs (listed as endangered in 1970). Black-tailed prairie dogs existed as part of an historical ecosystem with large herds of bison, covering millions
The FWS estimates that the species range has been diminished by 99 percent, primarily due to poisoning and agricultural conversion, and vulnerability to the sylvatic plague. While the listing petition noted that the “role of black-tailed prairie dogs in maintaining the short-grass prairie ecosystem is increasingly hard to evaluate, as that ecosystem has been so extensively fragmented and modified by human activities,” Reading et al. (1989) provided a listing of the over one hundred vertebrate species that have been found associated with colonies of black-tailed prairie dogs and concluded that the diversity of animal species, especially birds, was directly correlated with size and proximity of prairie dog colonies. Prairie dogs have been found to increase both animal and plant diversity on the plains. Grazing by prairie dogs and large ungulate species provide access to soil and insects, unobstructed sight-lines and relative safety for a wide range of migratory bird species. The prairie dog serves as a prey base for the endangered black-footed ferret, swift fox, badger, and ferruginous hawk. They leave vacant burrows for the Burrowing Owl, the Black-footed Ferret, the Texas Horned Lizard, rabbits, hares and snakes. Furthermore, the burrowing and grazing activities of prairie dogs affect many other ecosystem functions and processes, including vegetation structure, plant composition, nutrients available in soil for plants, soil turnover, soil chemistry, energy flows, nutrient quality of plants, and plant succulence.

Declining Mitigation Opportunities
Viable populations of many species, including the prairie dog, require a large land base and some opportunities are simply lost as parcels develop. Meanwhile, agricultural land conversion continually diminishes conservation opportunities and species status as well; 1.4 million acres or over 5% of the Eastern Plains were converted from agriculture, including the ranching compatible with many declining species, to other land uses between 1987 and 1997, at an accelerating pace according to the State Department of Agriculture. The scarcity of prime mitigation parcels with very large prairie dog complexes also had the potential to increase project costs. CDOT realized that project-by-project mitigation over the next 20 years would be likely to cost much more, to be less environmentally valuable, and require a higher mitigation ratio than advance mitigation.

Opportunities

Identified Conservation Priorities
Informal and formal conservation plans recently developed by the Colorado Division of Wildlife (DOW) as part of their Legacy program and The Nature Conservancy’s (TNC) ecoregional planning effort provided a jumping off point for discussions on how CDOT could partner with these entities to direct mitigation resources to areas of greatest benefit. Based on field observations and research on populations of over a hundred declining plant and animal species and communities, the conservation plans outlined large-scale bubble areas where viable communities existed. Utilizing the research already performed, these conservation target areas became the starting point for CDOT and FHWA's multi-species advance mitigation effort.

New Regulatory Vehicles under the Endangered Species Act
The FWS’s new regulatory vehicle, Candidate Conservation Agreements with Assurances (CCAA) are designed to protect species not yet listed as threatened or endangered, but considered to be in decline and could be listed in the future. With the 1982 amendments, Congress allowed the federal government to provide regulatory assurances to non-federal property owners through the section 10 incidental take permit process. A CCAA is designed to contribute to recovery efforts and identifies actions the landowner commits to take to conserve declining species, including habitat protection. Participating non-federal landowners receive assurances from the agencies that no additional conservation measures above and beyond those contained in the CCAA will be required and that no additional land, water, or resource-use restrictions will be imposed upon them should the species become listed in the future. As the Federal Register announcement noted, “a major incentive for property owner participation in the...Candidate Conservation program is the long-term certainty the programs provide... Much of the nation’s current and potential habitat for listed, proposed and candidate species exists on property owned by private citizens, States...and other non-federal entities. Conservation

---

1 "[a plain] is intirely occupyed by the burrows of the barking squiril hertefore described; this anamal appears here in infinite numbers and the shortness and virdu[r]e of grass gave the plain the appearance throughout it's whole extent of beatifull bowling-green in fine order. It's aspect is S.E. a grea number of wolves of the small kind, halks [hawks] and some pole-cats were to be seen. I presume that those animals feed on this squirril." Merriwether Lewis, Journals of Lewis and Clark, Sept. 17, 1804.
efforts on non-federal lands are critical to the long-term conservation of declining species...a collaborative stewardship approach is critical for the success of such an initiative. Permits issued to provide assurances for activities to be conducted under a CCAA become effective upon the effective date of a final rule listing any of the covered species as threatened or endangered.” The final rule allows more flexibility where the permittee is a State or local governmental entity." FWS’s special cooperative relationship with states is further clarified in the agency’s July 1994 interagency policy on the role of State agencies in activities undertaken by the Services under the authority of the ESA and associated regulations in title 50 Code of Federal Regulations. That policy recognizes States’ “unique position to assist the Services in implementing all aspects of the Act. In this regard, section 6 of the Act provides that the Services shall cooperate to the maximum extent practicable with the States in carrying out the program authorized by the Act.”

Methodology

Identification of Target Species
The initial analysis area, the area from the foothills east to the Kansas border (roughly I-25 and east), covered 27 million acres or 42,717 square miles, including an estimated 89,446 acres of CDOT right-of-way (ROW) in four of CDOT’s six Regions. The CDOW, TNC and the Colorado Natural Heritage Program (CNHP) identified 95 declining animal and plant species within that area. CDOT and CNHP-CSU assembled existing biological information from the various public and private resource and conservation organizations in the state including DOW, TNC, and CNHP’s own databases. This information was supplemented with individual and group consultation with the state’s top species experts and researchers, working for resource agencies, universities, independently, and for private conservation groups. Species occurring in the central shortgrass prairie, were included in the analysis if they met two criteria:

• Potential for impact by CDOT transportation projects, maintenance actions, and bridge replacements.
• Potential for the species in question to be listed as threatened or endangered under the Federal Endangered Species Act.

The initial list of species was developed and reviewed by the Director of Conservation for The Nature Conservancy of Colorado, Colorado Natural Heritage Program biologists, the FWS Colorado Division Manager, and the Colorado Division of Wildlife’s Endangered Species Manager. After all existing information was collected and assembled in a geographic information system, CDOT and CNHP met with the top bird, mammal, amphibian, reptile, plant, invertebrate, and fish experts in the state, individually and in groups to gather input.

Impact Analysis
The partners developed an estimate of the collective impacts to the habitats of declining species in the Eastern Plains from proposed transportation projects over the next 20 years. The agreement and programmatic Biological Assessment cover the full gamut of CDOT project types on the existing road network and existing bridges in need of repair over the next 20 years. CDOT’s 20-year plan anticipates safety, reconstruction, capacity, and other transportation improvements for 22% of the highway network in Colorado’s central shortgrass prairie (over and above overlay projects, which are expected to have minimal impacts). Any new alignment to be constructed by CDOT in this period is beyond the scope of the agreement and programmatic Biological Assessment, and would require its own Biological Assessment and appropriate management practices or conservation measures.

There were two primary components to the impact analysis: 1) identification of range and distribution and 2) calculation of impacted acres based on defined impact zones. According to interagency discussion and decision to use best available data, in accordance with the ESA, the analysis was conducted using existing GIS data only, supplemented with consultation with widely recognized experts in each taxonomic group (herpetiles, birds, fish, mammals, invertebrates, and plants) on range and distribution for each species. Current understanding of range and distribution was mapped as “assumed presence.” Experts also provided guidance and direction on the types of impacts that might be expected from routine highway maintenance and reconstruction on the existing network. This guidance was used to conservatively estimate “impact zones,” or spatial representations of assumed impact that can be used to calculate total impacted acres of habitat for each species.
Conservation Site Identification

A panel headed by state biologists and including TNC and the Rocky Mountain Bird Observatory identified priority habitat conservation sites that could serve as large-scale conservation/mitigation areas for the target species. CDOT is evaluating this information as it becomes available and then recommending sites to FHWA and FWS for approval. CDOT will then purchase real property interests in selected sites from willing sellers, with the intent that federal-aid projects will reimburse the state for mitigation credits as they are used. The site identification panel is developing site-specific management plans and agreements for the preferred habitat and real property interests, on behalf of CDOT, and making recommendations on which entity could best manage the site(s). Subsequent agreements will be executed detailing the administration, management, and reporting/monitoring for the acquired property interests, in accordance with applicable state and federal laws.

Approach to the Programmatic Agreement

CDOT, FHWA, and FWS had the following primary considerations in choosing and/or developing a regulatory vehicle to implement the Shortgrass Prairie Initiative. The agencies aimed to develop an agreement and accompanying regulatory document that would:

- Allow resources to go to habitat conservation, instead of ongoing process/reporting
- Explicitly acknowledge and accommodate federal participation in the state initiative
- Offer an incentive, such as regulatory assurances, for conservation of candidate or declining species in advance of listing
- Minimize/avoid through programmatic agreement the biological surveying that would otherwise be required on a project basis
- Mitigate by ratio of impact area to conservation area, with associated accounting/reporting
- Resist legal challenge to the maximum extent practicable.

Using All Regulatory Flexibility

As they encountered challenges, CDOT and FHWA staff utilized agency policies supporting a proactive ecosystem and outlining the DOTs ability to work with quasi-public resource conservation entities to accomplish the plan’s objectives. Of particular use was FHWA’s July 1995 Guidelines for Federal-aid Participation in the mitigation of Impacts to Upland Ecosystems and the Establishment of Ecological Mitigation Banks. That guidance supported the formation of partnerships among levels of government and with non-governmental stakeholders, including partnering with non-profit resource management interests or agencies for land management and ownership; established a preference for mitigation activities providing multi-species or ecosystem benefits; and promoted utilization of existing authorities to perform advance mitigation.

The team also drew on National Wildlife Federation v. Babbitt, a particularly influential case decided in October 2000. Though that case overturned an incidental take permit issued by the FWS, Judge Levi’s ruling upheld several key approaches utilized in the Shortgrass Prairie Initiative:

- a habitat approach to mitigation for listed and unlisted species,
- a flat less than 1:1 mitigation ratio for all impacts regardless of quality,
- targeting of mitigation dollars to higher quality and higher priority conservation lands in the area under consideration,
- general assessments of the impacts of development on habitat rather than quantitative information on individual species members, and
- that use of “best available scientific and commercial data” under the ESA does not require complete or perfect data.

For the Shortgrass Prairie Initiative, FWS staff actively utilized their prerogative to move the analysis and agreement forward using best available; i.e. currently existing data, for an area that had relatively few comprehensive biological inventories, relative to other ecoregions. Use of best available data allowed the team to reach conclusions and move the project forward in a timely fashion that contributed greatly toward the momentum and practicability of the project for all parties. The team also learned from weaker aspects of the subject of the case, and planned to locate and fund all conservation parcels in advance of impacts, to increase certainty of implementation of the conservation measures.
Anticipating and Avoiding the Need for Reinitiation of ESA Section 7 Consultation

CDOT, FHWA, and FWS structured the scope of the analysis and the conservation area to anticipate and avoid the need for reinitiation of ESA section 7 consultation to the maximum extent possible for the impacts of federal actions/transportation improvement projects (including reconstruction, safety or capacity improvements, bridge improvements, or resurfacing) on the existing roadway network over the next 20 years. As provided in 50 CFR 402.16, reinitiation of formal consultation is required if:

A. The amount or extent of incidental take is exceeded;
B. New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in the Biological Opinion (BO);
C. The action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in the BO; or
D. A new species listing or critical habitat designation occurs that may be affected by the action.

The agencies sought to avoid reinitiation of formal consultation in the following ways. With regard to 1) above, the possibility of exceeding the amount or extent of incidental take was minimized by conducting the analysis planning for section 7 compliance on the entire State and Federal Highway systems in the Eastern Plains. Buffer distances were proposed and approved by statewide experts in each taxonomic group, leaving only the construction of new alignment that would add to the extent of incidental take. In the case of construction of new alignment, FHWA agreed to initiate site-specific consultation with FWS as necessary.

With regard to 2) the partners sought to overestimate the manner and extent in which agency action could affect threatened, endangered, or candidate species and critical habitat, to compensate now, to the extent possible, for information that is currently unknown about subject species and habitats. The impact assessment treated all highway ROW as habitat, regardless of quality or presence of individual species in any particular place, and irrespective of current maintenance practices (e.g. mowing the entire ROW is standard practice). Furthermore, avoidance and minimization of impacts, as required by the ESA, was agreed to be accomplished via minimization of the project footprint and through BMPs minimizing direct and indirect impacts. CDOT, FHWA, and FWS agreed to work together to institute more beneficial practices and to incorporate the new information if subsequent information reveals that CDOT management practices can be improved to benefit or minimize harm to threatened, endangered or candidate species.

With regard to 3) above, since the initiative covers only ongoing activities on existing roads and no new road construction, the partners agreed that it is unlikely that the agency action will be modified to such a degree that any of the covered species will be affected in a manner or to an extent not anticipated in the CNHP/CDOT impact assessment. The partners were aware that planned transportation improvements will change as the Transportation Commission of Colorado considers needs and priorities over the next 20 years; however, by including the whole highway network and associated bridges, each species’ range across the Eastern Plains, and areas of potential impact for each species in the impact assessment, they agreed that the “action” subject to section 7 will likely not be modified except by the addition of new alignment, which would most likely require its own section 7 consultation or reinitiation of the section 7 consultation for such a project.

Finally, with regard to 4) above, the partners noted that species could be listed or critical habitat could be designated that their agreement neither anticipates nor includes, and that initiation of section 7 consultation could be required at the time of such listing. The initiative addresses a primary shortlist of species. CDOT and FHWA took the conservative approach of treating all vegetation and habitats associated with the included species as potential habitat for those species, regardless of condition or presence of those species. Therefore, species presence was overestimated. Compliance with future designation of critical habitat should be likewise streamlined. The process and agreement was based on the best available information about the species and habitats in question, to which the parties have added the best available knowledge of recognized state experts in shortgrass prairie species and ecosystems, covering all taxonomic groups.

Choice of Regulatory Document

The FWS, FHWA, and CDOT decided on a modified or programmatic section 7 approach, whereby a conventional BA and BO would address listed species and an addendum to both documents would describe how non-listed declining species were incorporated and addressed with conservation measures in similar fashion. The layout of the regulatory document follows the FWS’s new guidance for programmatic section 7 consultation with FHWA, issued in November 2000. According to the plan outlined by the agencies, CDOT’s
and the FWS Region’s executive directors will sign on to a conservation strategy for all the listed and non-listed species, contained within the BA and the BO.

Current Status
At this point, executive directors of all the partnering agencies and organizations have signed a Memorandum of Agreement outlining the purposes of the effort, the methodology described herein, and the process under which they will proceed. The agreement is somewhat unique among the small number of programmatic ESA section 7 agreements in place around the country for DOT impacts, in that it focuses on declining as well as listed species and covers the full range of projects a DOT may undertake and the impacts that may occur. Most often, programmatic agreements are developed and implemented for “No effect” projects or for “Not Likely to Adversely Affect” projects. Here, taking a broader scale approach with a longer timeframe, CDOT and FHWA will cover bridge replacements and four-laning highways and still benefit the species in question, with the intention of making a tangible contribution to species recovery. Property and easement purchases for the Shortgrass Prairie Initiative are currently in process and scheduled to be completed in 2002.

References
From 64 FR 32705-32716, in particular 64 FR 32709.
July 1994 interagency policy on the role of State agencies in activities undertaken by the Services under the authority of the ESA
Abstract
The relationship between a proposed transportation project and resulting land use changes must be analyzed to fully assess the effects of the project under section 7 consultation for the Endangered Species Act (ESA). This can be a complex, confusing and even controversial task. This issue becomes increasingly important as expanding human populations place more pressure on wild species and habitats; as more species are listed in developing areas and as transportation agencies move toward earlier coordination on environmental issues in project planning.

Develop an approach for addressing indirect effects of transportation projects in ESA consultations. Under the ESA federal agencies, must consult with the National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (USFWS) to determine the effects of federally funded project actions on threatened and endangered species. The consultation process includes an analysis of direct and indirect effects of the action as well as the effects of any interrelated or interdependent activities on listed species.

According to ESA definitions, direct effects occur at or very close to the time of the action itself. Examples could include construction noise disturbance, loss of habitat, or sedimentation that results from construction activity. Indirect effects are those that are caused by the action and are later in time (after the action is completed) but still reasonably certain to occur. General examples include, changes to ecological systems such as predator/prey relationships, long-term habitat changes, or anticipated changes in human activities including changes in land use.

Indirect effects for transportation projects can include changes in land use such as the development of undeveloped areas, when that change is induced by the action or can reasonably be expected to result from the action, which is the subject of consultation.

Attention has often focused on the direct effects of habitat impacts or construction disturbance, but, questions also may arise regarding the relationship of a transportation project to land development in nearby areas and whether such development is considered an indirect effect as defined under the ESA. The causal relationships are not always plain and can vary with different circumstances. New roads may provide access to new areas and encourage land use change. At the same time, in some cases rapid urbanization can occur with little change to road infrastructure, though congestion relief projects may be triggered after the fact. Determining how to address these different situations is critical to effectively conducting ESA consultations on transportation projects.

WSDOT has coordinated an effort to develop guidance for addressing this issue. This document provides general guidance and a method for reviewing and analyzing the indirect effects relationship between transportation and land use development during the ESA consultation process. This approach help to identify 1) the types of projects which may lead to indirect effects, 2) when and how indirect effects may result, and 3) how these relate to determining the overall effect of the project on listed species. This approach has been developed through extensive coordination between WSDOT, NMFS, USFWS, as well as local and state land use planning and transportation organizations. This method is now being used in Washington State.
NEPA AND TRANSPORTATION: NEED AND STRATEGIES FOR EARLY INVOLVEMENT

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Abstract: The National Environmental Policy Act (NEPA) is to encourage “productive and enjoyable harmony” between humans and their environment, and to encourage wise, i.e., sustainable, decisions. The CEQ implementing regulations require early involvement to “insure planning and decisions reflect environmental values; avoid delays later in the process; and head off potential conflicts.” Additional benefits of early involvement as well as the consequences and symptoms of late involvement are discussed. Based upon EPA Region 10’s experience, the attributes of early involvement are outreach; integration of land use planning, transportation planning, and environmental review; revised/standardized guidance for elements of the NEPA EIS process and other topics; programmatic procedures for legal compliance where appropriate; advance planning for compensatory habitat mitigation; and adoption of an Environmental Management System for construction, operation, and maintenance of transportation infrastructure. The Oregon “Collaborative Environmental and Transportation Agreement on Streamlining” (CETAS) process is highlighted as an example that embodies all six attributes.

What is NEPA?
The National Environmental Policy Act (NEPA) of 1969 is a statement of national environmental policy for the purpose of encouraging “productive and enjoyable harmony” between humans and their environment such that we “fulfill the responsibilities of each generation as trustee of the environment for succeeding generations”. The intent of the NEPA is to foster wise decisions – those that are productive, harmonious, and sustainable.

To carry out this intent, the NEPA also establishes a process that is integral to the decision making of all federal agencies whenever they propose to take an action that may have significant environmental impacts. For such proposed actions, Federal agencies must prepare an Environmental Impact Statement (EIS) that discloses to the public and decision makers key information such as (1) the purpose and need for the action; (2) a reasonable range of alternatives for meeting the stated need; (3) a description of the affected environment; and (4) the anticipated environmental impacts, including any unavoidable effects, effects on long-term productivity, and irreversible and irretrievable commitments of resources should the proposed action be implemented.

Why Have Early Involvement?
The regulations for implementing the NEPA require early involvement. Early involvement is described as the integration of the NEPA process with other planning at the earliest possible time in order to “insure planning and decisions reflect environmental values; avoid delays later in the process; and head off potential conflicts.” [Council on Environmental Quality (CEQ) regulations, Section 1501.2] The CEQ offers further guidance in their document entitled, the “Forty Most Asked Questions Concerning CEQ's NEPA Regulations.” Here the CEQ indicates that Federal agencies are required to “take steps...to ensure that environmental factors are considered at an early stage in the planning process and to avoid the situation where the applicant for a federal permit or approval has completed planning and eliminated all alternatives to the proposed action by the time the EIS process commences or before the EIS process has been completed.” CEQ indicates that those steps or procedures should include an “outreach program” to bring about consultations with private parties and state and local entities.

The benefits of early involvement include those stated above and much more. A process crafted to ensure early involvement also provides the potential for establishing good working relationships and partnerships among agencies and other participants; for enabling decisions that “stick”, which needn’t be revisited unless there is significant new information or changes in circumstances; for maximizing avoidance of environmental harm; for developing compensatory mitigation plans that maximize environmental benefits; and for lowering project delays and costs, thereby realizing the desired effect of “streamlining” the environmental review process.
In EPA Region 10 (the states of Alaska, Idaho, Oregon, and Washington), and we suspect elsewhere in the U.S., late involvement, i.e., the application of NEPA after substantive land use and transportation decisions have been made, has been “the norm” since the NEPA’s passage more than 30 years ago. Late involvement results when there is a chasm between land use planning, transportation planning, and the initiation of the EIS process. In theory and according to intent, the NEPA process begins as soon as the potential for needed federal action can be foreseen. The reality is that it has not, because the NEPA process has been viewed as equivalent to the EIS process when, in fact, it is much more than that. To be legally sufficient and to be effective in practice, the NEPA process must include early involvement in planning.

Unfortunately, in most cases land use planning and transportation planning have occurred separately in a linear or sequential manner, or they may have some level of integration, such as factoring in comprehensive land use plans when transportation plans are developed. Once the planning decisions have been made, the state and/or local entities may turn to the Federal government for funds, permits, or other actions, to implement their transportation decisions. This is when project proponents have initiated the EIS process, which has and still does result in a process that is geared to support pre-determined outcome(s). Within the NEPA EIS process, the symptoms of this condition include:

- Excessively narrowed purpose and need statement;
- Constricted range of alternatives, including lack of consideration of changes to land use and/or transportation plans;
- Incomplete analyses of impacts, especially with respect to cumulative and secondary effects (induced growth, sprawl, climate change), high value habitats and listed/candidate/sensitive species, community impacts and environmental justice;
- Public participation process that does not effectively engage and respond to the affected public;
- Heightened reliance upon compensatory mitigation as a response to project impacts; and
- Project proponents’ reliance upon project momentum to overcome objections.

These procedural deficiencies, ensuing conflicts, and the environmental costs associated with the outcomes have driven resource agencies, particularly EPA, to proactively seek opportunities for earlier involvement, while conflict, costs, project delays, and legislation (TEA-21, the Transportation Equity Act for the 21st Century) have moved transportation entities to seek avenues for “streamlining.” It appears the solutions for both early involvement and streamlining are the same.

What Are the Attributes of Early Involvement, a.k.a. Streamlining?
While the stimulus and emphasis of this paper is primarily upon the need for early incorporation of environmental concerns into land use and transportation planning, effective environmental management in transportation actually requires early action at all stages – from planning through decision making, implementation and evaluation. Thus, the attributes of a comprehensive early involvement process are identical to many of those being pursued for the environmental streamlining of transportation projects in various states. These include:

1. Outreach to land use and transportation planning entities;
2. Integration of land use planning, transportation planning, and environmental protection;
3. Revision and standardization of guidance for implementing key elements of the NEPA EIS process;
4. Application of programmatic procedures for legal compliance, such as with the Endangered Species Act (ESA);
5. Advanced planning for compensatory habitat mitigation; and
6. Adoption of an Environmental Management System for construction, operation, and maintenance of transportation infrastructure.

This paper will address attributes 1, 2 and 3 as they relate to EPA Region 10 activities.

The Oregon Collaborative Environmental and Transportation Agreement on Streamlining (CETAS) process is highlighted as an example, where the state of Oregon has undergone joint interagency process improvement to eventually incorporate all six attributes.
Outreach
Other than suggesting outreach in the form of pre-application consultations and publication of pre-application procedures, the CEQ simply directs federal agencies to “take steps” to ensure early involvement in planning. Outreach is defined in Webster’s dictionary as “an organized effort to extend services beyond usual limits, as to particular segments of a community.”

In response to the need for earlier involvement, EPA Region 10 developed and published a document referred to as the Region’s “transportation message.” Entitled, Transportation Planning in the Northwest: Framework for Sustainability (EPA 910-F-00-001, January 2000) the document is intended for land use planning and transportation planning entities, decision makers, and the public. Dissemination of the transportation message is a proactive effort to urge all communities and Metropolitan Planning Organizations to integrate land use planning, transportation planning, and environmental review. The hope is that this integration will enable and foster the generation of a range of alternatives that is potentially more protective of environmental, as well as social and economic, values. Joint agency letters and presentations (such as, FHWA and EPA) to target audiences, the use of websites, and resource agency liaisons to state and local entities are also possible means of outreach.

Integration of Land Use Planning, Transportation Planning, and Environmental Protection
The integration of land use planning, transportation planning, and environmental review is clearly the most daunting, yet critical of all early involvement endeavors. Federal agencies are hampered by the stigma of Federal meddling in local land use decisions. At the state level, the transportation departments claim no control over this aspect. State growth management or land use laws—where they exist—have some influence over local land use planning processes, but none in the Pacific Northwest have successfully brought about this critical integration.

There appear to be two general approaches to solving this problem: (1) Resource agencies can collectively or individually pursue strategic, proactive involvement in specific regional and/or local land use plans, and/or in state, regional and local transportation plans; or (2) resource agencies, state and Federal transportation agencies, and appropriate regional and local entities can engage in joint interagency process improvement. In EPA Region 10, both approaches are being tried, but the most efficient, desirable, and hopefully successful one may be the latter collaborative approach. Pilot projects are now underway in the states of Washington and Oregon to test new processes.

An example of the collaborative approach that serves as a showcase for all the desired attributes of early involvement is the Oregon “Collaborative Environmental and Transportation Agreement on Streamlining” (CETAS) process. The CETAS process formed from attempts to revise or replace the Oregon NEPA/404 Accord. The Accord, or Merger Agreement as it is called in some states, was a process deemed necessary and promoted by Federal Highway Administration (FHWA) in 1992. For agencies signatory to the agreement, there are in most cases concurrence points at specific points in the NEPA EIS process, such as for purpose and need, the range of alternatives, the preferred alternative, and proposed mitigation. The object was to engage resource agencies earlier in the NEPA process and to merge the reviews needed for compliance with the NEPA and Clean Water Act Section 404, permitting for wetlands dredge and fill.

The status quo in Oregon was that, as in so many other states, the NEPA EIS process and application of the Accord with resource agency involvement occurred too late in the process, i.e., not until the project development phase, to affect land use and transportation decision making. Land use planning, transportation systems planning, and corridor or “Refinement Planning” as it is called in Oregon, in which modal and location decisions are made, had all taken place prior to resource agency involvement. Figure 1: “The Way It Was,” illustrates this sequence of events. The result of the CETAS was a new charter, a new process agreement, and a vision that fully integrates land use planning, transportation planning, and environmental review.
Figure 1: The Way It Was. Note that the resource agencies are not involved until the Project Development stage.
The new charter (see Appendix), signed in February 2001, is the “Collaborative Environmental Group Charter” (Charter). It is an umbrella agreement among agencies that sets the stage for further collaborative work to achieve their collective vision. The new process agreement, which is to be signed in November 2001, is called the “Agreement for Environmental Streamlining of Major Transportation Projects” (Agreement). The objectives of this agreement are to ensure full communication, participation, and early involvement in Oregon Department of Transportation’s (ODOT) major transportation projects: those processed with an EIS or Environmental Assessment (EA) that are likely to impact natural resources.

The process as per the Agreement (see Figure 2: The Way It Almost Is Now) covers projects in Oregon’s Refinement Planning stage, which is equivalent to a NEPA Tier 1 EIS process, and it covers projects in the Project Development stage, which is equivalent to a NEPA Tier 2 EIS process. Refinement plans are typically used for large, long-term projects that will result in a location decision. There are agency concurrence points at key junctures: purpose and need, range of alternatives, preferred alternative, and selected alternative. The Project Development or Tier 2 stage is for projects where mode and location have been determined. The same concurrence points are applied at this stage, except that Purpose and Need concurrence occurs only if the project did not go through Refinement Planning (Tier 1).
Figure 2: The Way It “Almost” Is Now. This diagram shows implementation of the CETAS Major Projects Agreement, which includes resource agency involvement in the Refinement Planning (NEPA EIS Tier 1) and Project Development (NEPA EIS Tier 2) stages. Signatory agencies have both concurrence authority and opportunities for comment and active participation.
It is the overall Vision (Figure 3) developed by the CETAS group that embodies the full process, where resource agencies are involved in the earliest stages of land use and transportation planning. Key elements of the Vision model include the following:

- Natural resource plans and resource mapping (including watershed plans) are developed and integrated with comprehensive land use and transportation planning;
- Federal lands management planning is integrated with transportation planning;
- Resource agencies have the opportunity for participation, comment, and concurrence at key points in the Refinement Planning and Project Development phases;
- There are programmatic applications, where appropriate, for regulatory requirements, such as under the Endangered Species Act (ESA);
- ODOT has a Habitat Mitigation Program, which includes advanced mitigation and mitigation banking;
- ODOT adopts a total Environmental Management System, ISO 14001, which is a structured process for analyzing, implementing, and accounting for a business enterprise’s environmental aspects in all its processes, products, and services; and
- ODOT works with local government, consultants, and contractors for seamless performance. This means that ODOT will:
  1. encourage local governments to also participate in the CETAS to enable early involvement of resource agencies. This early involvement includes using resource agency plans and resource mapping to inform the land use planning process, and to invite participation of resource agency staff;
  2. move environmental awareness into their transportation systems planning; and
  3. ensure that ODOT contractors perform in accord with the environmental commitments that ODOT has made.
Figure 3: The Vision. This diagram shows resource agency early involvement and streamlining at every stage, including local land use planning, transportation systems planning, refinement planning (NEPA EIS Tier 1), project development (NEPA EIS Tier 2), mitigation, and incorporation of an Environmental Management System (EMS) during construction/operations/maintenance.
ODOT and the CETAS Group are moving forward with each of the above elements of streamlining, but at this point, they are further ahead with some elements than with others. Presently, the most ambitious element—the integration of land use planning, transportation planning, and environmental review—is still largely in the conceptual stage. A report on the successes, failures, and lessons learned concerning these efforts would be valuable.

Revised/Standardized Guidance for Key Elements of the NEPA EIS Process
Both in Washington, and in Oregon pursuant to the CETAS Charter, ad hoc workgroups are convening to revise or develop standardized guidance for elements of the EIS process as well as for aspects that are not addressed within NEPA. Examples under NEPA include purpose and need guidance, public participation guidance, guidance for assessing cumulative and secondary effects, community impacts assessment guidance, and landscape level/watershed based approaches to mitigation. Outside NEPA, for example, the Oregon CETAS group intends to address storm water.

These proactive efforts to develop procedures contribute to project streamlining, because they eliminate the need to “reinvent the wheel” for each project. They also contribute to the integrity of the NEPA process, because the process for developing them is collaborative, which enables the purpose, spirit, and intent of NEPA to be fully incorporated.

Conclusion
Oregon is not alone in their quest for a new, more enlightened process for implementing the NEPA. Many other states in the U.S. are in the process of revising their NEPA/404 Merger agreements, and they seem to be moving toward the same outcome, albeit at their own pace. While six attributes of early involvement have been discussed, it is the second attribute—to integrate land use planning, transportation planning, and environmental review—that this author believes is most central to the concept of early involvement and vital to effecting more desirable, sustainable environmental outcomes. Unfortunately, it is also the most elusive and challenging element to implement. Future conferences and other appropriate forums on progress in this area would be very beneficial.

Biographical Sketch: Elaine Somers has been with the EPA since 1983. For the past six years, Elaine has worked in the NEPA/309 Environmental Review program, and has served as the lead on Transportation. She has a B.S. in Botany and a Masters in Forest Resources Management (Natural Ecosystems Management program) from the University of Washington. Elaine’s graduate studies emphasis was upon wildlife and conservation biology.

References


CETAS, Agreement for Environmental Streamlining of Major Transportation Projects (Agreement), to be signed November, 2001.

APPENDIX
A VISION FOR JOINT ENVIRONMENTAL AND TRANSPORTATION SYSTEM STEWARDSHIP IN OREGON COLLABORATIVE ENVIRONMENTAL AND TRANSPORTATION AGREEMENT FOR STREAMLINING (CETAS)

CHARTER AGREEMENT

I. Introduction
The CETAS Group was formed in June of 2000 in response to several issues: a greater and greater sense of urgency about environmental stresses; the response to TEA-21 streamlining; the complexity of environmental regulation and planning requirements; and the need to update and fully implement the existing NEPA/404 Accord. Old processes were no longer adequate for the tasks at hand. The CETAS group was formed out of a desire for a more harmonious and streamlined process for meeting agencies’ missions.

II. Goal
The goal of this Group is to identify and implement collaborative opportunities to help each participating agency realize its mission through sound environmental stewardship, while providing for a safe and efficient transportation system. Our direction for achieving this goal is derived from Table 1, which sets out the Group’s vision.

III. Balancing of Values
In pursuing this goal, the ethic is one of balancing environmental and transportation values. Through earlier and more effective communication, mutual education, and process change, greater environmental benefits can be accomplished, while minimizing costs and delays. The ultimate goal is the improved outcome for each agency’s mission.

When making environment-related decisions, CETAS participants share the responsibility to balance competing business needs and requirements with appropriate environmental stewardship. Schedule, cost, safety, quality, public input, regulatory input, fish and wildlife habitat and other factors are all top priority, while none have first priority.

Under §7(a)(1) of the Endangered Species Act, the Federal Highway Administration and the Oregon Department of Transportation shall use all of their authorities to conserve listed species and the ecosystems upon which they depend. With that vision, transportation planning and programs will use this authority to protect and restore habitat for listed species.

Under the authority of the National Environmental Policy Act, the Fish and Wildlife Coordination Act, the Clean Water Act, and other statutes, typically avoidance of environmental impacts is the highest priority. The best stewardship of the resource is to avoid harm in the first place. If the resource cannot be avoided, then minimize harm to the maximum extent possible and practicable. Where the resource cannot be avoided, and where minimization leaves harm to the resource, mitigate or offset the harm. In addition, sound environmental stewardship requires that, on all projects, decision-makers be mindful of environmental enhancement opportunities, and take advantage of them when appropriate.

IV. Membership and Responsibilities
A. The CETAS is composed of one representative, and one alternate from each of the following agencies:
- the Oregon Department of Transportation,
- the Federal Highway Administration,
- the Oregon Division of State Lands,
- the Oregon Department of Environmental Quality,
- the Oregon Department of Fish and Wildlife,
- the Department of Land Conservation and Development,
- the Environmental Protection Agency,
the US Fish and Wildlife Service,
the US Army Corps of Engineers, and
the National Marine Fisheries Service.

B. CETAS members agree to:
• come to the CETAS meetings to share their individual opinions and knowledge,
• represent their agency's position fully,
• listen respectfully,
• ensure that the CETAS decision reflects agency positions rather than individual opinions, and receives full understanding and full agency ratification, and
• ensure that their agency develops an implementation plan, where relevant, for CETAS work products and the long-term implementation of CETAS agreements.

C. Decision-Making. Subject to statutory and legal constraints the following will occur:
• Decisions will be made by consensus of the participants. Consensus is defined as the willingness of all the participants to accept the decision and abide by it. It is understood that the decision may not represent the optimal outcome for any one participant, but it is an acceptable outcome to all.
• By agreeing to consensus, each member supports the decision.

D. Attendance
• Members agree to attend regular meetings of the CETAS.
• An alternate will be thoroughly briefed on the issues by their agency's CETAS representative prior to the meetings.
• Seven participants constitutes a quorum.

V. Meetings

A. Timing of Meetings
• ODOT representative will convene quarterly CETAS meetings for the purpose of information sharing, monitoring of ongoing CETAS work products, and addressing other work issues,
• ODOT may convene additional meetings as the need arises;
• At the request of two or more agencies, or as specified in any of the CETAS work products, ODOT shall convene additional meetings.

B. ODOT will provide for minutes.

C. Annually, ODOT Environmental Services shall prepare and present a report summarizing and evaluating the work of the CETAS, its workgroups, and the implementation of its work products.

VI. Task of the CETAS
It is the task of the CETAS to:
• provide a forum for exchange of information and perspectives;
• establish collaborative opportunities for its work groups to resolve;
• establish work groups;
• monitor the progress of work groups;
• approve work group products;
• implement CETAS agreements;
• monitor the implementation of CETAS agreements; and
• engage in other activities as the group decides.
VII. Workgroups

A. Workgroups may be used to prepare specific proposals or draft agreements. Workgroups will:
   • be subject to the groundrules established by this charter, unless otherwise specifically directed;
   • to the extent possible, reflect a balance of interests;
   • make regular progress reports to the CETAS Group.

B. The work products should include the following:
   • conditions of the agreement
   • education plan
   • implementation plan
   • monitoring and assessment mechanism
   • durability of the agreement
   • conflict resolution process, if appropriate

C. The Work product shall not be considered final until approved by the CETAS.

VIII. Elevation of Contested Issues
Elevation should be used whenever participants feel the decision needs to be made at a higher level, participants feel the agreement is not being upheld, or participants cannot concur with a proposed activity. Elevation is a positive step in appropriately resolving issues. The sequence for each of the agencies identified in Table 2.
Abstract: This paper discusses the environmental review involved in the Environmental Impact Statement (EIS) for 4 miles of new highway through a relatively pristine large contiguous forest, palustrine forested wetlands containing forest interior dwelling birds and coastal plain stream. The EIS presents the results of the Maryland’s Streamlined Environmental and Regulatory Process (2000) that has been completed to address both National Environmental Policy Act (NEPA) and U. S. Army Corps of Engineers (USACE) Section 404 Permit requirements. The process involved invertebrate sampling, electrofishing, and wetland delineation. The jurisdictional determination field reviews lasted for weeks. The interagency team selected the preferred crossing of Windlass Run and revisions were made to the selected alternate to minimize environmental impacts. Functional assessment of the wetlands involved a shortened version of Evaluation of Planned Wetlands. Secondary and cumulative effects were considered, which involved a land use study conducted by a team of real estate professionals and engineers to illustrate the need for the highway, which was to provide improved access from the regional transportation network to planned major economic sites. Original estimates of wetland impacts from a previous study averaged 25 acres, and this was narrowed by avoidance and minimization to 9.3 acres. The Integrated NEPA/404 Process saved time and money and should be considered for other projects wherever possible.

Introduction
The Maryland State Highway Administration (SHA) considered several alternatives for directly connecting Eastern Avenue (MD 150) in Southeastern Baltimore County with two major transportation routes: Interstate 95 and US 40. The purpose of this project is to provide a sufficient level of access and mobility to support Baltimore County’s economic development efforts within the designated Middle River Employment Center. Baltimore County has targeted much of the study area for future employment growth through its countywide Growth Management Plan. An objective of that plan is to maintain an adequate supply of prime industrial land served by public infrastructure to encourage employment-generating development and redevelopment, while still preserving the rural character of two thirds of the County’s land area. Toward this end, the County designated several areas as Employment Centers, and specifically identified the Middle River Employment Center (MREC) as being a major component of the Eastern Baltimore County Revitalization Strategy, which was adopted by the Baltimore County Council in July 1996.

Methodology
The NEPA/404 merger process was initiated to streamline project decisionmaking on Federal-aid Highway projects. The reason for merging the NEPA and Section 404 processes is to provide the opportunity to expedite project decisionmaking by executing one overall Federal public interest decision, at one point in time, for a Federal-aid project. Both processes involve evaluation of alternatives and assessment of effect to resources against the need for the project, and officials of all environmental regulatory/resource agencies involved recognized the opportunity to avoid duplication and inefficiencies within them.

The streamlined process provides numerous opportunities for agency input and includes requests for formal concurrence or comment at three key milestones: 1) purpose and need, 2) alternatives retained for detailed study, and 3) selected alternative and conceptual mitigation. It is the responsibilities of the agencies to participate in the Interagency Review Meetings and provide input at the concurrence points.

Figure 1 documents Maryland’s Streamlined Environmental/Regulatory Process.
Fig. 1. Streamlined Environmental/Regulatory Process
Fig. 1 continued. Streamlined Environmental/Regulatory Process
In general, the project-planning phase of the highway development process will incorporate the streamlined process until alternatives are developed and preliminary environmental impacts are identified. At the Interagency Review Meeting for Alternatives Retained for Detailed Study, the agencies will reevaluate their level of involvement in the project based on its environmental impacts and will decide whether formal concurrence points are still appropriate.

Study Area
The study area for the Middle River Employment Center Access Study (MRECA) is located in southeastern Baltimore County, within the coastal plain, and is bounded by Ebenezer Road to the north and MD 150 (Eastern Avenue) to the east and south. Wampler Road generally defines the western boundary except for a corridor where MD 43 (White Marsh Boulevard) extends westward from its eastern terminus at US 40. Via this corridor the highway interchange of MD 43 and I-95 is included within the project area and defines its westernmost point. The project area contains approximately 8.6 square miles, and its boundaries are generally parallel to those of the Middle River Employment Center as identified in the Eastern Baltimore County Revitalization Strategy.

The MRECA study area lies entirely within the Chesapeake Bay drainage area on the Atlantic Coastal Plain in eastern Baltimore County, Maryland. Six surface streams drain portions of the study area. Three of them (Whitemarsh Run, Honeygo Run, and Windlass Run) are primary tributaries to Bird River. Whitemarsh and Honeygo Runs originate in the Piedmont region west of the coastal plain and descend onto the Atlantic Coastal Plain before emptying into Bird River, whereas Windlass Run lies entirely within the coastal plain (Maryland Department of Natural Resources, 1998). Bird River is a tributary to the Gunpowder River, which discharges directly into Chesapeake Bay. Maryland Department of the Environment (MDE) classifies all of the non-tidal streams in the study area as Use-I, which designates use for water contact recreation and the protection of aquatic life.

Windlass Run and Whitemarsh Run, which lie well within the study area, will both have to be crossed regardless which build alternate is selected, so stream studies for this project have been primarily directed toward those two subwatersheds.

Windlass Run is a small narrow stream where it flows through the study area. At no point is it wider than ten feet, and in the upper reaches of the study area it is generally less than three feet wide and braided. The bottom substrate is a very soft muck. Typical of coastal plain streams, riffle and pool areas in Windlass Run are rare and generally small. However, aquatic vegetation and snags are common in many parts of the stream and provide plentiful habitat for aquatic life. The stream is relatively undisturbed (compared to other nearby streams) and there is a buffer of at least 100 meters from human development along much of its channel.

Whitemarsh Run has a 25-foot wide channel in many places. Some of the pools exceed six feet in depth, but most of the stream is shallow. The substrate is primarily soft sand and the channel is straight with minimal bank stabilization. Overhanging vegetation and some snags provide most in-stream habitats; macrophytic vegetation is rare. The stream channel is within 100 meters of human activity throughout much of its course, and trash lies on many of the banks. Tires and concrete debris are common in the stream.

Alternatives
Numerous alternative alignments had been considered for this project, but after extensive study by representatives of the SHA, Baltimore County, and environmental agencies, and after receiving valuable input from citizens attending a public workshop, the list of proposed alternatives had been reduced to six.

The first option is a No-Build Alternative, which does not meet project objectives but will continue to be studied as a base case to compare with the build options. The first of the build options, Alternative D, provides direct access to the MREC, has the least amount of socio-economic impacts, and is similar to a route that the Land Use Analysis Committee recommended as being the most effective for promoting economic development activities. It is also the alternative that has received the most public support. Alternative D (Modified) is similar to Alternative D and retains all of Alternative D’s advantages while providing for a less environmentally-damaging crossing of Windlass Run and improved access to the developable parcels of the MREC, as seen in Figure 2. Alternative E provides good access to the MREC and has relatively minimal environmental impacts,
but while it avoids properties of historic importance, a greater number of residential properties would be affected than in most of the other options. Alternative F1 (Modified) has minimal socio-economic impacts and provides for a less environmentally damaging crossing of Windlass Run, but more wetlands would be impacted, and access to the developable parcels of the MREC would be relatively less. Alternative I (Modified) provides good access to the MREC and has the fewest commercial and total displacements. It also provides for a less environmentally damaging crossing of Windlass Run, as well as reduced wetlands impacts.

Fig. 2. Key Development Parcels “Source: Maryland State Highway Administration”
It was initially determined that Alternative D Modified provided the best overall response to the project's Purpose and Need, while at the same time minimizing environmental impacts. At this point, SHA initiated additional studies in an effort to further reduce impacts to the environment as a result of implementing Alternative D Modified. This resulted in several changes to Alternative D Modified, creating Revised Alternative D Modified, including a reduction of the median width from 34 feet to 24 feet in areas of no proposed intersections, thereby reducing wetland impacts.

Table 1 summarizes the impacts studied.

Table 1
Summary of Impacts (Natural Environment)

<table>
<thead>
<tr>
<th>Feature</th>
<th>DEIS Alternatives</th>
<th>SHA Selected Alternative</th>
<th>Revised D Mod</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit</td>
<td>No Build</td>
<td>D</td>
</tr>
<tr>
<td>Natural Environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical Area</td>
<td>Acre</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wetlands</td>
<td>Acre</td>
<td>0</td>
<td>8.5</td>
</tr>
<tr>
<td>Streams Crossed</td>
<td>No.</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Stream Impacts</td>
<td>L.F.</td>
<td>0</td>
<td>420</td>
</tr>
<tr>
<td>Floodplain Encroachment</td>
<td>Acre</td>
<td>0</td>
<td>2.8</td>
</tr>
<tr>
<td>Forest Impacts</td>
<td>Acre</td>
<td>0</td>
<td>51.5</td>
</tr>
<tr>
<td>100+ Acres Contiguous Forest Blocks</td>
<td>No.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Rare, Threatened, or Endangered Species-Federal</td>
<td>No. of Sites</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Noise Impacts</td>
<td>No.</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Air Quality Impacts</td>
<td>No.</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1 Additional wetlands were found west of Bird River Road, which total 0.26 acres. This amount has been added to Alternatives D-Mod, D, E and I-Mod.

2 NSAs that approach or exceed Federal Noise Abatement Criteria or have a 10 dBA or greater increase.

3 Sites Exceeding S/NAAQs.

Key points that led to this decision are as follows:

- Revised D Modified provides the most direct access to key undeveloped upland parcels of land currently zoned for development in the Middle River Employment Center, therefore best addresses the purpose and need of the project.
- Revised D Modified is one of three alternatives that provide direct access to additional developable parcels as well as existing development at the Chesapeake Industrial Park, the Federal Depot and the Martin State Airport.
- Revised D Modified impacts a range of 9.6 to 9.8 acres of wetlands for both the alternative and its associated access roads, one of the least of all the alternatives.
- Revised D Modified directly impacts 390 linear feet of streams, the least of all the alternatives (same as D Modified).
- Revised D Modified crosses Windlass Run at the Corps of Engineers' second preferred crossing, F1 Modified being the first choice.
- Revised D Modified avoids several BGE high-tension transmission towers. Avoidance of these towers will reduce the construction cost by approximately $5 million and cut 12 months off of the lead-time needed to relocate the towers.

Based upon the stream classification of Windlass Run and actual field verified wetland limits, Revised Alternative D Modified (Selected Alternative)/ Alternative D-Modified/I-Modified crossing was the preferred location by the regulatory/resource agencies because it appeared to be the narrowest crossing in the most
disturbed and unstable stream section of Windlass Run. This section of stream had the highest degree of entrenchment as compared to the other alternatives.

The crossing of Windlass Run for the other alternatives has moderate channel entrenchment with a floodplain that is much broader and exhibits a seasonally saturated condition. As a result, flood abatement and water quality functions at these crossing locations appear to be the greatest. These crossings would affect more jurisdictional wetland area.

The proposed alternative crossings of Windlass Run include a culvert and two bridge systems. Detailed hydrologic, hydraulic, and geomorphic analysis was completed for the proposed Revised Alternative D Modified crossing. This crossing is the furthest downstream and therefore represents a “worst case” scenario for the extent, elevation, and discharge characteristics of the 100-year flood. Physical channel conditions were assessed using the procedures and methodologies outlined in A Classification for Natural River Systems (Rosgen, 1994). The geomorphic analysis of the existing conditions at the Revised Alternative D Modified crossing classified the stream as a C5 with a bankfull width of approximately 15 ft. and a maximum depth over 2 ft. The hydraulics analysis results in existing 100-year flood elevations in the vicinity of the crossing to be between 19 to 21 feet above sea level.

Wetland Delineation

This project was fast tracked, and A. D. Marble and Century Engineering personnel began the wetland delineation and the aquatic fauna survey in the fall of 1998. We had the jurisdictional determination field reviews in December 1998 through March 1999, which involved wetland delineation during winter conditions.

Since the overall project schedule was aggressive, the wetland delineation process was expedited. The surveyors staked the centerlines of the alternatives retained for detailed study, and were followed closely by the delineation teams. Impenetrable green brier and multiflora rose hampered the delineation efforts. Global Positioning System (GPS) units were used to locate the wetland flags to sub-meter accuracy to hasten the process. The USACE field reviews were scheduled before the flagging was finished. Hunting season also caused a delay since we were forced to stop early one day due to gunfire.

Wetland Mitigation

The SHA Selected Alternative involves the unavoidable impact to coastal plain forested and emergent wetlands within the watersheds of Bird River and Middle River. The area of this impact is 9.3 acres. As a result, a site search was conducted by the SHA Office of Environmental Programs, consistent with the guidelines of the Maryland Compensatory Mitigation Guidance (1994), to identify one or more sites sufficient to mitigate for the unavoidable wetland impact. The replacement ratio for wetland mitigation is 2:1.

Following the steps outlined by the NEPA and 404 guidelines, the proposed impacts must be mitigated by: avoidance, minimization and compensation. Non-forested sites greater than 5 acres underlain by soils with wetness limitations or adjacent to NWI-mapped wetlands, floodplains or streams were identified as potential mitigation sites.

More than 60 potential mitigation sites were evaluated in an effort to identify suitable opportunities for compensatory wetland mitigation. Through a series of increasingly more detailed site-specific evaluations, the five most promising sites were selected for a field review with regulatory agencies.

Following the field review, the USACE and MDE staff identified two sites as their preferred potential mitigation sites. However, the property owner of one of the sites has plans for development of the parcel on which the potential mitigation site was identified and access to the site has been denied.

To meet the estimated 18.6 acres of wetland mitigation for this project, SHA proposes a two level approach that will allow SHA flexibility and the regulatory agencies surety should one of the preferred mitigation sites be found infeasible for the creation of wetlands. The main components of the package include non-tidal wetland creation, enhancement, restoration and preservation, in addition to afforestation and preservation of forested drainage areas contributing to the creation and enhancement sites. The proposed Level 1 includes the use of preferred Site # 21 (U. of MD Foundation), and the western portion of Site #25 (Back River Neck Road) which
potentially may provide 14.9 acres and 4.4 acres of mitigation credit, respectively. These two sites collectively exceed the 1:1 ratio for no net loss, as well as, exceed the estimated mitigation for the project. The proposed Level 2 includes alternative sites, Site #11 (DNR) and the entire Site #25. These sites could provide sufficient acreage should one or all of the Level 1 sites prove to be infeasible.

This information describes the efforts undertaken to identify sites with the potential to be used for compensating for unavoidable wetland impacts associated with the MRECAS project. The technical approach used to identify sites with the greatest potential to provide opportunities for wetland creation consisted of the following:

- Objectively identify the universe of potential forested wetland mitigation sites in the project area, the Bird River watershed and the Middle River watershed;
- Score and rank this list of potential mitigation sites and select a number of the highest ranked sites suitable for further investigation; and
- Subject this second set of sites to a further prioritization effort to identify sites appropriate for regulatory agency consideration; and
- Review this set of sites with regulatory staff and obtain a consensus on the best sites for wetland compensatory mitigation.

Each site included in the field review with the USACE and MDE is summarized with a narrative description of the existing conditions, a brief discussion of the proposed mitigation approach, and the consensus final site disposition. All sites were visited before the final consensus was reached. In this respect, the regulatory and SHA consensus decision that a site could be dropped from further consideration as a mitigation site for MRECAS project impacts indicates only that better mitigation opportunities exist on another potential mitigation site evaluated during the course of this study.

Site #21 University of Maryland Foundation Site
This site consists of two adjoining parcels totaling 50 acres owned by the University of Maryland Foundation. Site #21 is located off Bird River Beach Road approximately 1 mile from the MRECAS project. The site drains to the Bird River downstream of the Windlass Run/Bird River confluence. The portion of the two parcels under consideration for mitigation consists of unreclaimed mined lands. The site is characterized by open water, unvegetated mud flats and clay pans and poorly vegetated slopes that are actively eroding, in addition to a variety of herbaceous and forested wetland and upland areas.

The general concept is to re-grade portions of the site to create vegetated wetlands while stabilizing severely eroded upland slopes which drain to existing and proposed on-site wetlands. The areas for wetland creation are located in a broad flat basin located in the lowest portion of the site. The use of wetland topsoil salvaged from the impact areas is proposed as topdressing providing biomass and a seed source for the newly created wetlands. The creation of wetlands and stabilization of the eroded slopes will compliment and enhance the values of the existing onsite wetlands and wildlife habitat. Existing herbaceous wetlands provide an opportunity for enhancement through the establishment of diverse wetland habitats such as forested and scrub/shrub wetlands. Relatively old and established mined out depressions, which appear much like vernal pools, will be preserved, along with the adjacent upland drainage areas which provide surface water flow and terrestrial habitat.

Site #25 Back River Neck Road
Site #25 is a 128-acre parcel located between Back River Neck Road and Holly Neck Road. The site consists of approximately 14 acres of crop field surrounded by upland and wetland forest. Soils mapped on the site include Mattapex, Barclay and Othello silt loams. A silt loam surface layer with moderately slow permeable subsoil of silt loam or silty clay loam characterizes the Mattapex-Barclay-Othello Association. This proved evident from several shallow soil borings conducted during preliminary site investigations. The slow permeable subsoil condition appeared to be exasperated in the crop field by years of plowing and compaction. This compaction of the subsoil allows for the perching of surfacewater that drains to shallow depressions in the field. The perching of surfacewater is also evident through much of the parcel. During the early portions of the growing season water covers numerous areas throughout the parcel. The exact extent of jurisdictional wetlands on the parcel has yet to be completed.
The mitigation concept for Site #25 is built upon the poor permeability of the subsoil. Through the creation of a mosaic of shallow depressions and hummocks, surface water can be trapped within the depressions developing numerous vernal or ephemeral pools. Hummocks would be planted with trees and shrubs with a gradient of wetter species of shrubs and emergents toward the center of the depressions. In addition to the creation of approximately 11.3 acres of such wetlands, the extensive forest located on this parcel further enhances the ecological value of the site. Through the preservation of these forested areas a more complete ecosystem approach could be developed for mitigation of proposed impacts from MRECAS. The USACE, FHWA and MDE have visited Site #25 and have concurred that the site may have potential for the creation of wetlands but recommend further hydrologic investigation and analysis to determine the true amount of potential wetland creation.

Site #11 Graces Quarter DNR Site
This site consists of three (3) parcels of agricultural land totaling approximately 53 acres. The State of Maryland (DNR) owns each parcel. The site is located on the south side of Grace Quarters Road just east of Ebenezer Road approximately 3 miles from the MRECAS site.

This site drains to a tributary of Dundee Creek. Tidal waters come to within 100 feet of the agricultural fields separated by a narrow band of forest. During the September site visit, groundwater was encountered in the top 36 inches and evidence of redoximorphic conditions were observed in the top 12 inches along the edges of the farm field. Existing vegetative cover was a mixed hayfield.

The concept for this area is to excavate and place soils to enhance surface ponding and lower the soil surface relative to the seasonal high ground water table. These activities will result in the creation of a more significant forested wetland buffer to two tidal water features and a significant tidal oligohaline/mesohaline marsh.

Secondary and Cumulative Impacts
The National Environmental Policy Act (NEPA) requires that any project having the potential to impact the environment to the extent that an Environmental Impact Statement is needed must address secondary and cumulative effects in addition to direct impacts. The proposed highway project meets this criterion.

The Council on Environmental Quality (CEQ) regulations for implementing NEPA broadly define “secondary impacts” as those that are “caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable” (40 CFR 1508.8). The CEQ provides further clarification in a guidance document entitled Considering Cumulative Effects, where it is stated that secondary or indirect effects might include: “growth inducing effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. Secondary impacts analysis, then, entails forecasting intended and unintended future effects which might result from an initial action and from any subsequent development brought about directly by the initial action.

Similarly, the CEQ regulations broadly define “cumulative impact” as “the impact on the environment which results from the incremental impact of the action when added to past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such actions” (40 CFR 1508.7). The purpose of cumulative impact analysis is to assure that agency decisions consider the full range of environmental consequences. Consequently, cumulative impacts can be substantially greater than and quite different from outcomes that might be expected when the same actions are considered singly. Cumulative impact analysis entails determining what actions have and will affect the SCEA boundary and then assessing the additive and interactive impacts of those actions along with their more singular effects.

The major regulatory/resource agency concern expressed about this project pertains to the direct and indirect loss of wetlands and wildlife habitat and the potential cumulative impacts which may occur with the Build Alternatives and associated development/ redevelopment of this area. Other concerns include impacts to cultural resources, environmental justice and residential displacement.

Table II provides a summary of the expected secondary and cumulative effects associated with the MRECAS project.
<table>
<thead>
<tr>
<th>Resource</th>
<th>Potential Secondary Effects</th>
<th>Potential Cumulative Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floodplains</td>
<td>Some development will occur adjacent to floodplains. Development restrictions within floodplains will minimize impacts.</td>
<td>Some development will likely occur adjacent to floodplains. Development restrictions within floodplains will minimize impacts.</td>
</tr>
<tr>
<td>Forests</td>
<td>There are over 400 acres of forests in the MREC. Most would be lost to development.</td>
<td>Trend analysis indicates a potential 7% loss of forested lands within the SCEA boundary. State regulations and conservation activities are striving to preserve remaining resources.</td>
</tr>
<tr>
<td>Water Resources</td>
<td>MREC borders Windlass Run. Also includes several un-named tributaries. Stream buffers will minimize impacts. Water and sewer service will be provided.</td>
<td>Anticipated future stresses on surface water quality will be stormwater runoff from urbanized areas and sedimentation/siltation from soil erosion/disturbance due to residential and commercial development. Current Baltimore County and MDE regulations are expected to protect groundwater resources.</td>
</tr>
<tr>
<td>Wetlands</td>
<td>Potential impact to isolated pockets within MREC. Alternatives that are removed from the MREC will require conversion of additional wetlands. Buffers will minimize impacts to wetlands adjacent to streams.</td>
<td>Regulatory programs will continue to reduce the conversion of wetland areas. An increased emphasis on wetland mitigation will strive to offset wetland disturbances caused by development actions.</td>
</tr>
<tr>
<td>Wildlife Habitat</td>
<td>MREC located on currently forested land, with a projection of over 400 acres of forest to be converted, which will cause forest habitat fragmentation.</td>
<td>Habitat loss is projected to continue. Expected stresses to wildlife species include increased noise pollution, increased disturbance during breeding and nesting seasons, and increased application of fertilizers.</td>
</tr>
<tr>
<td>Rare, Threatened and</td>
<td>Loss of contiguous forest in MREC may effect species that depend on forest interior habitats.</td>
<td>Certain species of concern, such as FIDS, may become even more rare, and especially vulnerable to extirpation.</td>
</tr>
<tr>
<td>Endangered Species</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results and Conclusion
This project invoked multiple agency cooperation starting at the beginning of the project. In addition to field reviews for wetland jurisdictional determinations, there were several field reviews to identify the least damaging crossing of Windlass Run. Much was accomplished by getting agency personnel in the field together with SHA engineers. There were numerous shifts in alignment to minimize impacts. The COE identified their own alternates, which were then evaluated by SHA.

The MRECAS project timeline started in August of 1997 with the first agency walk through and is nearly complete with the FEIS approval by the Federal Highway Administration (FHWA) in April 2001. The Record of Decision was signed by FHWA in May 2001. The groundwork has been laid for the approval of wetland impacts for access roads for the development of the employment center. It should be noted that the largest parcel of land for the employment center has been studied for alternate development plans for over a decade, but has been never received approvals due to wetland/environmental impacts. Original estimates of wetland impacts from a previous study averaged 25 acres, and this was narrowed to 9.3 acres.

The Pennsylvania Department of Transportation (PennDOT) has used a streamlined decision making process and has estimated that on three projects PennDOT saved $119 million (10-13% of total construction costs). Each project reduced the amount of time for NEPA/404 approval by nearly 70% of the 5.6-year average. Using the Streamlined Environmental and Regulatory Process, Maryland was able to complete the environmental process for a historic bridge replacement project requiring an environmental impact statement (EIS) in one year. Typically, completing environmental reviews for that type of project might have taken two to three years.

The Pennsylvania Department of Transportation/Pennsylvania Turnpike Commission NEPA/404 Merger Process Team received a national award for cutting red tape and improving customer service during the highway development process. The Integrated NEPA/404 Process saved time and money and should be considered wherever possible.

References
Maryland Department of the Environment. 1994. Maryland Compensatory Mitigation Guidance
Maryland State Highway Administration. 2000. Maryland’s Streamlined Environmental and Regulatory Process
PENNSYLVANIA’S CORRIDOR O: A MODEL FOR INTERACTIVE DESIGN

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Abstract: Under the current Environmental Impact Statement (EIS) project development process, the Pennsylvania Department of Transportation (PENNDOT) typically develops engineering alternatives which are presented to the State and Federal resource agencies, local governmental organizations, and the public (these three groups are known as the project stakeholders). Afterward, PENNDOT solicits comments and makes revisions to the alternatives. Although effective, this process often creates feelings of confusion and mistrust between the stakeholders and the Project Team, which can lead to costly project delays as seen in many other large projects.

Problem Approach: Interactive Design
The TEA-21 Restoration Act (1998) called for the use of environmental streamlining techniques for the Corridor O Project, a new 25 mile highway in Centre and Clearfield Counties, PA. With Corridor O, PENNDOT sought a process that would enable the stakeholders to develop the alternatives during an open forum. The primary difference is that the new Corridor O Project Development Process is oriented toward stakeholder involvement throughout the decision-making process rather than at the end. Instead of PENNDOT generating alignments, a bi-directional approach is used in which the stakeholders initially develop alignments, PENNDOT then reviews and revises them, and the stakeholders reassess and narrow the options until a preferred alternative is selected. By allowing the stakeholders to generate alignments and examine impacts while making decisions, a feeling of trust is generated. It also enables the stakeholders to see first hand why certain decisions are made, and what the basis for those decisions is throughout the process.

Introduction
The S.R. 0322, Section B02 Project, commonly known as the Corridor O Project, involves investigations into the location of a limited-access highway along existing U.S. Route 322 between Interstate 99 in Port Matilda, Centre County, and Interstate 80 in Clearfield County, Pennsylvania. The Corridor O Project Area spans approximately 59,300 acres of land within twelve municipalities, with a maximum width of about 5 miles, and a length of about 25 miles.

This project was authorized in the 1998 Transportation Equity Act for the 21st Century (TEA-21) to complete a portion of the Appalachian Development Highway System (ADHS) and to provide a connection between I-99 and I-80 along U.S. Route 322. The ADHS was developed by the Appalachian Regional Commission to help upgrade substandard, unsafe and inadequate roadways that have plagued mountainous areas in the eastern United States since the 1950s. The ADHS is designed to provide the entire Appalachian region with a modern system of four-lane highways complemented by access roads that link the system to industrial and commercial sites. The language in Section 1309 of the TEA-21 includes initiatives related to environmental streamlining that have provided PENNDOT an opportunity to develop a new, refined approach to transportation project study, evaluation and documentation.

Environmental Streamlining
Environmental Streamlining is defined by the Mid-Atlantic Transportation and Environment (MATE) Task Force as "a cooperative and coordinated process that assures timely, cost effective, and environmentally sound transportation planning and project development based upon concurrent, multi-agency review" (MATE, 2000).
The Pennsylvania Department of Transportation (PENNDOT) has been following many of the guiding principles of environmental streamlining since 1992 with the Integrated National Environmental Policy Act/Section 404 process. PENNDOT has been working with Pennsylvania state and federal resource agencies in cooperative agreements that have set the framework for concurrent agency reviews and active participation by the agencies throughout a given project.

Over the last several years, particularly since the TEA-21 legislation, people have been discussing environmental streamlining and its implications on transportation projects. Too often, the initial reaction is of concern that environmental analyses will become obsolete. However, we have come to learn that environmental streamlining is about coordination and review, not an attempt to shortchange the fulfillment of environmental laws and regulations.

The project team and PENNDOT examined the work of the Mid-Atlantic Transportation and Environment Task Force (spearheaded by the USEPA), the Federal Highway Administration, and PENNDOT for examples that illustrate environmental streamlining goals and principles. It was clear that most of the goals were achievable if PENNDOT were to implement them on a new highway project. Based on these factors, Corridor O was selected as the model project to implement these streamlining principles.

**PENNDOT’s Approach**

PENNDOT’s Transportation Project Development Process for Environmental Impact Statements (EIS) involves a series of Ten Steps along with a number of consensus points (Figure 1). The procedure was developed to pertain more to the involvement of state and federal resource agencies rather than the public. However good this process worked in the past for PENNDOT, it has been clear over the last several years that the coordination and project development process could be and should be improved. Feelings of distrust and a general lack of cooperation often stood in the way of sound transportation planning. In addition, PENNDOT realized that a key component was missing from the planning table – the local perspective.

The lack of public participation and understanding coupled with the growing sense of mistrust among state and federal resource agencies, PENNDOT sought to develop a new process that incorporated environmental streamlining techniques and actively involved project stakeholders. In response, PENNDOT and the Project Team developed a new project development process to expand public and agency input while streamlining the documentation and consensus points. This process incorporates a funnel analogy to illustrate the process of narrowing the range of alternatives (Figure 2).

**A New Project Development Process**

Based on the initiatives related to environmental streamlining contained in Section 1309 of the TEA-21, PENNDOT sought to create a new process that would enable the stakeholders to actively participate in the generation and refinement of alternatives for Corridor O during an open forum. This new process would allow the stakeholders to be actively involved throughout the decision-making process. To accomplish this, the Corridor O Project is using a new Four-Stage Project Development Process (Figure 2) that includes several interactive design workshops.
Figure 1
Transportation Project
Development Process Flow Diagram
Environmental Impact Statements
FIGURE 2
CORRIDOR O PROJECT
DEVELOPMENT PROCESS

- Complete Project Purpose & Need
- Begin Public Outreach Program
- Identify Performance Measures
- Begin Environmental Overview Data Collection

- Complete Environmental Overview
- Develop Initial Alternatives
- Conduct Performance Based Alternatives Analysis

- Conduct Desktop Environmental Study
- Produce Preliminary Conceptual Designs
- Public Involvement

- Distribution of Draft EIR/Section 106 Report
- Identification of Preferred Alternative
- Public Hearing

SELECTED ALTERNATIVE CONSENSUS

Visioning Stage
Development Stage
Refinement Stage
Final Comparison Stage
Visioning Stage
The first stage of the project development process is the Visioning Stage, which was designed to help the communities gain a better understanding of the changes a new highway may bring to the area. This stage of the project coincides with the traditional purpose and need evaluation as well as the affected environment section of an Environmental Impact Statement.

Development Stage
The second stage of the project is known as the Development Stage. The primary purpose of this stage is to develop the preliminary alternatives, and to determine which of these alternatives merit detailed analysis based on their ability to meet the project needs and project performance measures. This stage coincides with the traditional preliminary alternatives or Phase I alternatives development process associated with an EIS.

Refinement Stage
The third stage of the project is called the Refinement Stage. The main purpose of this stage will be to refine the mainline alternatives based upon additional engineering and environmental studies and to identify potential interchange locations and designs. This stage is comparable to the traditional detailed or Phase II alternatives analysis, and will contain many of the elements of the Environmental Consequences and Mitigation Section of an EIS.

Final Comparison Stage
The last stage of the project is called the Final Comparison Stage. This stage will be used to study the preferred alternative in detail and to minimize any impacts that this alternative has to the social or natural environment.

This stage is comparable to the traditional discussion related to the identification of a preferred alternative in an EIS.

The information addressed in the above described environmental streamlining process will address Pennsylvania Act 120 requirements, the USACOE Public Interest Factors as contained in the Section 404 Regulations, the FHWA requirements for project documentation, and will address all of the factors identified in the CEQ regulations found in Part 1500. More specifically, although not in the same format, will address all of the considerations, and contain all of the information found at Part 1502 relating to EIS preparation. As such, this format will provide sufficient information at an appropriate level of detail to support decision-making processes at both the state and Federal levels.

With this process, the alternatives are developed based upon a number of different inputs, such as traffic needs, community goals, environmental concerns, demographics, resource agency ideas, and others. The focus of this process is active stakeholder involvement. PENNDOT achieved this active involvement through an extensive public outreach program and a dynamic, reciprocal process for development of alternatives.

Active Stakeholder Involvement
Project stakeholders are defined as Private Citizens, Municipal/Government Officials, Business Leaders, State/Federal Resource Agency Representatives, and Special Interest Groups. Active stakeholder involvement includes a dynamic exchange of information disseminated in more than just routine public meetings and project newsletters. The Project Team has come up with several innovative concepts designed to help empower the stakeholders, to hold their attention and enthusiasm for the project, and to present project information in a creative manner that evokes thought and concern, not mistrust and miscommunication.

Active stakeholder involvement also includes access to all available data, and the provision of this data based on a “real time” timeframe - basically delivered to stakeholders as soon as it is discovered in the field and in the analysis. The end product of Active Stakeholder Involvement is a sense of trust and respect for all parties involved, including the project team and PENNDOT. The provision of project details in a timely, concise and creative way facilitates informed dialogue during consensus building exercises and provides the opportunity for face-to-face contact.
Alternatives Development

Developing an alternatives analysis process that is accepted by all project stakeholders is a key component for any successful highway development project. This process must consider several elements, including: 1) the project needs; 2) public concerns; 3) natural, cultural, and socioeconomic resources; and 4) engineering constraints. As with all transportation projects, the alternatives must first be weighed against the project needs to ensure that these needs are met in order to provide for a safe and efficient highway system. However, further comparison must be performed to determine which alternatives best fit the needs and concerns of the public while minimizing impacts to the natural, cultural, and socioeconomic environment.

The process of analyzing alternatives is often difficult to explain to the Community Advisory Committee (CAC), the resource agencies, and the public. Most stakeholders understand that alternatives must meet the project needs. The confusion and debate regarding the alternatives revolves around the acceptable degree of impact on the competing resources. The Project Performance Measures (Figure 3) are designed to identify the different stakeholders’ concerns regarding sensitive resources in the project area, and provide a documented framework for assessing the degree of alternative impacts to these resources. This framework is agreed upon by the stakeholders at the beginning of the project, to avoid future confusion and debate as alternatives are developed.

For Corridor O, alternatives that meet the project needs are carried forward and compared to the Project Performance Measures, as depicted in Figure 4. The Performance Measures act as an additional set of standards (beyond the project needs) that are used to weigh each alternative. Those alternatives that best meet these Performance Measures are carried forward for additional study. Final analysis based on Project Performance Measures can then be used to identify the preferred alternative and to refine this alternative during final design.

The Corridor O Project Team has illustrated this process using a modification of the alternatives analysis process discussed in Mastering NEPA: A Step-by-Step Approach (Bass and Herson 1993). All of the alternatives are evaluated for their ability to meet the project needs. Only some of the alternatives will meet this test. Those that meet the project needs are then carried forward to be compared against the Project Performance Measures (the second test).
Figure 3: Project Performance Measures

<table>
<thead>
<tr>
<th>TRANSPORTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reduce and divert through traffic from local roadway network (C) (P)</td>
</tr>
<tr>
<td>2. Substantial reduction of through truck traffic from Route 280, Route 37, Route 202 and Route 504 (C) (P)</td>
</tr>
<tr>
<td>3. Reduce travel time to Delta Change and points west (C) (P)</td>
</tr>
<tr>
<td>4. Maintain traffic congestion and utility problems at Woodland (C) (P)</td>
</tr>
<tr>
<td>5. Provide direct connection with Corridor Q near Woodland where the traffic is generated (C) (P)</td>
</tr>
<tr>
<td>6. Substantial reduction of through truck traffic on Route 280 (P)</td>
</tr>
<tr>
<td>7. Substantial reduction of through truck traffic on Route 37 (P)</td>
</tr>
<tr>
<td>8. Provide for adequate auxiliary and local traffic (C) (P)</td>
</tr>
<tr>
<td>9. Accommodate regional and local travel demand (P)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ENVIRONMENTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Minimize vehicle travel and commercial activity (C) (P)</td>
</tr>
<tr>
<td>2. Reduce the risk of volcanoes and other natural disasters (C) (P)</td>
</tr>
<tr>
<td>3. Accommodate agricultural lands and suitable agricultural security areas (C) (P)</td>
</tr>
<tr>
<td>4. Avoid impact to known species and potential species and their habitats (C) (P)</td>
</tr>
<tr>
<td>5. Accommodate the needs of the community, environmental, and recreational resources (C) (P)</td>
</tr>
<tr>
<td>6. Minimize exposure of potential hazards to human health (C) (P)</td>
</tr>
<tr>
<td>7. Minimize exposure of potential hazards to the environment (C) (P)</td>
</tr>
<tr>
<td>8. Minimize exposure of potential hazards to infrastructure (C) (P)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Design for high road design, high road design, high road design, high road design (C) (P)</td>
</tr>
<tr>
<td>2. Provide for the needs of the community, environmental, and recreational resources (C) (P)</td>
</tr>
<tr>
<td>3. Provide for the needs of the community, environmental, and recreational resources (C) (P)</td>
</tr>
<tr>
<td>4. Develop an incident management plan for point communities (C) (P)</td>
</tr>
<tr>
<td>5. Provide for the needs of the community, environmental, and recreational resources (C) (P)</td>
</tr>
<tr>
<td>6. Consider changes to traffic patterns (C) (P)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNITY AND LAND USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Minimize exposure of potential hazards to human health (C) (P)</td>
</tr>
<tr>
<td>2. Minimize exposure of potential hazards to the environment (C) (P)</td>
</tr>
<tr>
<td>3. Minimize exposure of potential hazards to infrastructure (C) (P)</td>
</tr>
<tr>
<td>4. Minimize exposure of potential hazards to human health (C) (P)</td>
</tr>
<tr>
<td>5. Minimize exposure of potential hazards to the environment (C) (P)</td>
</tr>
<tr>
<td>6. Minimize exposure of potential hazards to infrastructure (C) (P)</td>
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ICOET 2001 Proceedings 237 A Time for Action
Figure 4: Corridor O Alternatives Analysis Process
Interactive Design
With Corridor O, PENNDOT sought a new process that would enable the stakeholders to develop the alternatives during an open forum. The primary difference between the old method and the new Corridor O Process is that the new method is oriented toward stakeholder involvement throughout the decision-making process rather than at the end. Instead of PENNDOT generating alignments, a bi-directional approach is used in which the stakeholders initially develop alignments, PENNDOT then reviews and revises them, and the stakeholders reassess and narrow the options, etc. until a preferred alternative is selected. By allowing the stakeholders to generate alignments and examine impacts while making decisions, a feeling of trust is generated. It also enables the stakeholders to see first hand why certain decisions are made, and what the basis for those decisions is throughout the process.

Interactive design workshops serve as the vehicle by which the stakeholders participate in the development and refinement of alternatives and the recommendation of a preferred alternative. The participants of the workshops include resource agency members and CAC members. The CAC members include local officials from the project area counties, boroughs, and townships, as well as members of active civic organizations within the region. By allowing the project stakeholders to actively participate in the generation and refinement of alternatives, a sense of “stakeholder ownership” is created.

All workshops are conducted using a basic format. Each workshop begins with a general introduction, which involves a description of the purpose and goals of the workshop, the work done to date, the resources to be presented for consideration, and the upcoming events that will ensue from the workshop. The participants then separate into teams to perform detailed alignment analyses (Photograph 1). The teams are organized to balance the interests of the resource agencies and to balance the geographic representation of the CAC. To do this, agency members with jurisdiction over similar resources were placed on each of the teams and CAC members from each of the three project area sections were placed on each team.

Once each team has fully assessed the alignments/tasks required, the teams reconvene for discussion. At the completion of discussion, suggested alignments or revisions to alignments/alternatives are agreed upon by consensus and the workshop is complete (Photograph 2).

The decisions made at the workshops are then presented to the public during a series of public meetings to solicit public comments. These comments are incorporated into the workshop designs, resulting in the finished alignment product for further study. By using this method, alignments/alternatives that best represent the needs and concerns of the citizens and resource agencies are generated. Using the interactive design workshops and public meetings, the Corridor O Project will be able to meet the accelerated schedule using new, innovative environmental streamlining concepts.

Highlights from the workshops include:
• State and Federal resource agencies and the Community Advisory Committee participation.
• Teams that balance geographic location and interests within the study area.
• Engineering templates used to draw alignment concepts on environmental features mapping
• Each team is given their own staff of consultant experts.
• CADD operators digitize the alignments as they are developed and projected on a screen for ease of viewing.
• GIS station available for instant check on impacts.
• Public provided opportunity to comment on workshop alignments.
• PENNDOT incorporates modifications as suggested by public into designs.

Public Outreach
The involvement of the public is a crucial and intrinsic part of PENNDOT’s Interactive Design Process. The public’s role in this process is analogous to a three-legged stool, in which PENNDOT, the resource agencies and the public/CAC represent each of the three equally supporting legs. If any one of the legs is removed, the entire structure is compromised.
An extensive public outreach campaign has been developed for the Corridor O project to keep the public informed about the project and its progression. An effective public outreach campaign must establish a set of goals early in the project, and focus on keeping these goals until the project’s completion. The goals of the Public Outreach campaign for Corridor O include:

- The promotion of public ownership of decisions and policies
- The creation of designs which were reflective of local goals and values
- The need to minimize rumors, distrust, and controversy between the public and cooperating agencies
- The development of a spirit of cooperation
- The enhancement of PENNDOT credibility

The most effective public outreach tool is the public meeting. These are held after each interactive design workshop. The public meetings are designed to allow the public to view mapping, attend presentations and speak to PENNDOT and other Project Team specialists about the status of the project, and their comments regarding the project and its impacts to resources. Due to the size of the project area, these meetings are held in three separate locations within the project area in order to attract as many local residents as possible. The first round of public meetings was held during the Visioning Stage of the project. The second, third and fourth rounds of public meetings took place during the Development Stage, and the fifth round of public meetings took place during the Refinement Stage.

The public meetings are held in an open house format, with poster presentations at several stations set up sequentially around a single room (Photograph 3). An example of a typical setup at a Corridor O public meeting might consist of the following stations: Project Development Process; Environmental Features; Cultural Resources; PENNDOT Right-of-way Procedures; the Intent-to-enter Process; the Alignment Drawing Workshop; and an Information Station.

There are also formal presentations held in conjunction with the open house poster presentations. Large maps scaled at one inch = 800 feet depict the alignments developed by the CAC and resource agency members (Photograph 4). At the Information Station, participants are asked to fill out questionnaires concerning the public meetings. Small maps are also typically available for the public to highlight their favorite or least favorite alignment, or draw in their own alignment. Computers are also made available at the Information Station so participants can get up-close views of alignments and the resources located in the vicinity of each alignment (Photograph 5). A Kid’s Corner Station is set up at each public meeting to keep children occupied with play activities while their parents can discuss project issues with project team members and PENNDOT in an undistracted setting (Photograph 6).

**Conclusion**
To date, this approach has saved at least one year, if not two, from the life of the project. PENNDOT anticipates continued timesavings that will result in long term savings in terms of construction costs. An added benefit to this approach is the reduction in controversy, both from the public as well as the state and federal resource agencies. The state and federal resource agencies have indicated their desire to use this approach on all future projects.

**Implications for the Future**
With this new interactive design approach, PENNDOT has raised the bar for its future projects. All of these measures are designed to allow for a more efficient design of alternatives and review process, thereby allowing the process to meet an accelerated deadline while producing the best possible solution to the problems at hand. Early and often stakeholder involvement, as well as the use of context sensitive design will produce a better product for which all stakeholders can be proud. As such, Corridor O is considered to be a pioneering project, developing more positive working relationships with the public and resource agencies, and taking new steps to improve the overall NEPA compliance process. Many aspects of this project will be useful as a template for other similar projects, and can serve to guide future projects toward creating additional successful environmental streamlining techniques.
References:

Photograph 1. Workshop participants utilized templates to draw alignments on large scale maps of the project study area.

Photograph 2. Sandra Martin presented the White Team’s findings during the consensus building portion of the workshop.
Photograph 3. Local area residents came out in full force to examine the Corridor O preliminary alternatives and other new information displayed during the February 2001 public meetings.

Photograph 4. Local residents review the alignments generated by the CAC and Resource Agency representatives during the Interactive design workshops.

Photograph 5. Computers provided the public with up-close aerial photography-based mapping of the initial alternatives and the natural, cultural, and socioeconomic resources of the project area.
Photograph 6. The kid’s corner station occupies children while parents are free to discuss project issues.
PRESERVING A SPIRIT OF PLACE: U. S. HIGHWAY 93 ON THE FLATHEAD INDIAN RESERVATION

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Abstract: US Highway 93 traverses the Flathead Indian Reservation, which is located on the west side of the Rocky Mountains in western Montana. Picturesque mountains and mountain valleys, with the broad Flathead Valley to the North and the majestic Mission Mountains to the East, characterize this part of Montana. The area is home to a wide variety of wildlife, including grizzly bear, white-tailed deer, mule deer, pronghorn, elk, painted turtles, bighorn sheep, and a number of fish and bird species. It is also home to the Confederated Salish and Kootenai Tribes of the Flathead Nation (CSKT).

Project History

We are all very proud to be here today and tell you our story of US 93 from Evaro to Polson, the agreement that was reached, and what it will mean to wildlife. We believe this is a very unique project and over time will prove to be the beginning of new understanding regarding wildlife and highways, along with others aspects of the agreement that are unique to how governments can work together.

This story began in the early 80’s when the MDT recognized the need to improve US 93 on the Flathead Reservation. Traffic was increasing significantly and the traveling public and traffic engineers were looking for some fixes. In response to the concerns four projects were proposed: Evaro to Missoula Co. Line, Missoula Co. Line to Ravalli, Ravalli North and Roan to Polson. Each of the four was set up to have individual environmental assessments (EAs).

I was not with the MDT at the time these four projects began. But, I was told that when the time came to coordinate with the Tribes on these four projects, the Tribes called for a time out. The total impact of four separate projects drew their attention. Even though they supported some of the projects, the Tribes were concerned that cumulatively the projects were going to have an impact on their home, their Reservation, and the impacts would not be analyzed properly unless tied together as one analysis. After much discussion between the governments (Federal, Tribal and State), the four projects were pulled and an EIS was started for the entire corridor length from Evaro to Polson, the logical termini for a corridor analysis (Reservation boundary to Polson, significant change in traffic).

A consulting firm, Morrison-Maierle Engineering, from Helena was selected and the process begun. The NOI for the entire corridor was sent on August 8, 1991. I joined the department in 1994 and at that time the process was moving very slowly, mostly because the position I took had been vacant for a year. One of my initial assignments was to get the EIS moving again and completed. The EIS and associated analysis was focusing on a four lane. At that time, two lanes were not given much thought. MDT and the consultant felt very strongly that
the road should be a four lane to accommodate present and future traffic needs based on standard design criteria being used at MDT. The traffic and safety studies completed on this road corridor would take up our entire hour plus some if we went into all of the details, but the purpose of our meeting today is to discuss how this project became a major wildlife connectivity project. Suffice it to say that traffic and safety studies were a big part of this effort, and played a key role in establishing MDT’s early position for this corridor.

A draft EIS was prepared in the fall of 1995. The Tribes continued to throw up a red flag and express concern for the project as a four-lane. In the spring of 1996 serious discussion began with the Tribes regarding the state’s and FHWA’s preferred alternative, four-lane, and the Tribes preferred alternative, 2-lane. Several issues came into play that made this an interesting discussion, but the most significant dealt with a clash of cultures: tribal culture versus DOT culture. Other issues were safety, traffic operation, commuter related population growth, access management, Ninepipe Wildlife Refuge, and bypasses of local communities. The time had come for the final EIS and a record of decision, the ROD.

The discussion moved into Tribal Council Chambers. The Tribal elders were against MDT’s preferred alternative of a four lane for the entire length from Evaro to Polson. They just did not like the project and what it would do to the homes of the member and future generations: seven generations. The Tribes believe that they must look forward seven generations and make decision today for the future. Allowing a four lane through the Reservation was not in keeping with this need to consider the future. The Tribal elders spoke and the Tribal Council voted to not support MDT’s preferred alternative: a unanimous vote against.

That was a shock to MDT. Also, the fact that MDT needed the Tribes to support their decision was also a shock: a cultural DOT shock!! What to do?? All three governments got together and decided to salvage as much of the EIS as possible and write a ROD that recognized the similarities and differences. That ROD came out from FHWA in August 1996.

The ROD was written such that it recognized no decision was made to construct a highway: “This decision does not provide for the physical construction of highway projects with Federal-aid funds until CSKT, MDT and FHWA agree on the appropriate design and a project level environmental document is completed that addresses social, economic, and environmental impacts” (August 12, 1996).

It did not take long for everyone who used US93 to recognize it was not getting any more pleasant to drive. Traffic was increasing and the overall situation was not improving. A mild attempt to get back together with the Tribes was made in the fall of 1996, but the general feeling was a period of time was necessary for all parties to digest the circumstances and exactly what had taken place the previous five years: August 1991 to August 1996, NOI to ROD.

In mid-1997 internal discussions began between MDT and FHWA on the ROD and questions were asked regarding exactly what activities it did allow. This led to an amendment to the ROD by FHWA in February 1998 that allowed access control and row to proceed on non-Tribal lands for “… acquisition of rights-of-way that does not preclude future options....” A consulting firm, Skillings and Connolly located in Lacy, Washington, was hired to do the access control study and access control plan. This contract was expanded to include purchase of access and rights-of-way.

By late 1998 the access control effort was working out very well and all three governments were satisfied with the process, and, as a result, discussion expanded to construction. At the beginning of 1999 discussion between the governments began for real and meetings were schedule to see what could be done to reach an agreement on lane configuration. The Tribal chairman at that time, Mickey Pablo personally became involved, as did the director for MDT, Marv Dye. In August 1999, the night before a meeting of the three governments, Mickey Pablo died suddenly. This was a truly tragic event, and it took four months to get the governments back together at the table. But in December of 1999, discussions on how to deal with the ROD and the needs for US93 began in earnest.

During the renewed talks the three governments agreed that they all wanted a third party consultant to facilitate an agreement that would result in a plan for US 93. Because of the success Skillings-Connolly was having with the access management plan, their familiarity with all three governments and their acceptance by
all three governments, they were selected to facilitate the effort. In March 2000, a contract with Skillings-Connolly was signed and the process began.

Collaborative Process
Lyle Renz, Skillings and Connolly Inc., Consulting Engineers

In 1998, the Montana Department of Transportation advertised a request for proposals targeted to consulting firms requesting preparation of an Access Control and Corridor Preservation Plan for Highway US 93 from Evaro to Polson, Montana. This highway covers a distance of approximately 56 miles.

There was a common theme in preparation of this proposal. The three governments felt that something needed to be done in the area of safety. They found that there were too many fatalities occurring on this state highway.

Skillings-Connolly's proposal preparation was based upon an extensive public involvement plan, which would create a collaborative process, guided by a steering committee, all of which would be facilitated by the engineering consultant firm of Skillings-Connolly, Inc. We were awarded the contract in late 1998, and immediately initiated a partnering session. The goal was to enlist all the appropriate and involved public groups in this project.

As a part of this partnering session, we set goals and objectives for the process and established a steering committee. This steering committee was composed of the Montana Department of Transportation, Confederated Salish and Kootenai Tribes of the Flathead Reservation, the Federal Highway Administration, Lake and Missoula Counties, and the incorporated cities within the corridor: Polson, Ravalli and St. Ignatius.

As we started the process, we held public meetings throughout the corridor. The key here was that we asked our steering committee, not just the consulting team, to participate in these open houses to enable the various partners to buy-into the process. We then held monthly steering committee meetings. These meetings were facilitated in such a manner that all decisions were by consensus. We felt the need to have full consensus before we moved onto the next item.

We developed an Access Control Plan for the corridor, again with participation by the steering committee and by the public at large. A key factor in designing the Access Control Plan was that the process was led by our sub-consultant, Robert Felsburg, of Felsburg, Holt & Ullvig (Denver, Colorado). Mr. Felsburg is a noted nationwide expert in access management. Another key in getting an Access Control Plan developed was that we held one-on-one meetings with every affected property owner in the corridor. By affected property owner, I mean those property owners from whom we would have to obtain an access, move an access, or purchase property. The property purchases would be necessary for the corridor preservation aspect of the project.

The corridor preservation aspect would preserve a corridor in which to build a roadway at a future date. The corridor needed to be wide enough to build within it the widest alternative discussed in the final EIS, which was a four-lane divided highway.

By October 1999, we had developed an Access Control Plan for the entire corridor. This plan included provisions for eliminating approximately 50 percent of the accesses within the corridor. This elimination was brought about by combining accesses; for example, many accesses that served individual properties were combined at the property line so that one access would serve both properties. We also put in frontage roads that gathered up accesses in close proximity, and served them through frontage roads with an access only at perhaps the end or middle of a frontage road; combining them into one or two accesses. In addition, outright closure of unneeded accesses was planned. Folks that had unused, extra, or field accesses were willing to give them up on the basis that something needed to be done, and someone would need to give up something to allow this improvement to be accomplished in this corridor.

Right-of-way plans were then put together for acquiring the right-of-way, and contracts negotiated with MDT for Skillings-Connolly to begin right-of-way acquisitions. This was accomplished late in 1999, and acquisitions began immediately thereafter.
As the corridor preservation project waned down and the right-of-way acquisition process had begun, the three governments met to discuss resuming the design discussion negotiating process, and to arrive at needed design issue decisions prior to building the highway. These issues dealt with lane configuration, specifically the kind of highway to be built, whether a four-lane highway or a two-lane highway. Other issues that were addressed had to do with design consideration and environmental impacts that would need to be mitigated.

After meeting for some time, the three governments again approached Skillings-Connolly to see if our firm would be interested in utilizing a process similar to the collaborative process used to design the Access Control and Corridor Preservation project. Skillings-Connolly agreed to provide a proposal to accomplish this. Through discussions it was decided that some additional elements should be brought into the process.

All of the governments had knowledge or experience with using the Midwest Research Institute (MRI) in previous traffic studies involving two-lane highways. As such, we were asked to contact Midwest Research Institute and bring them in as a sub-consultant to analyze this highway from the standpoint of making a two-lane highway with passing lanes.

MRI had designed a computer program, “TwoPas,” which was a simulation model. This simulated drivers on a two-lane road who were looking for passing opportunities. Generally, these opportunities would need to occur at a minimum of every two miles to train drivers to wait for passing opportunities, when the passing lanes were available. MRI had perfected the model in this regard, and it was thought that this would prove helpful to utilize this model in analyses, and in negotiating a lane configuration solution.

Other well-thought-of sub-consultants were Jones and Jones, Architects and Landscape Architects, Inc., from Seattle, WA. They were brought in since they played a big role in solving a long-standing highway dispute issue in Kentucky, referred to as the Paris Pike issue.

In addition, Herrera Environmental Consultants was brought in to deal with the environmental issues. Herrera has extensive experience in dealing with a wide-range of environmental impacts associated with highway projects throughout the Northwest and has done environmental analysis on projects in unique settings for National Forests and Parks for the Federal Highway Administration. For the next year, throughout the year 2000, the group met monthly to discuss the direction in which to proceed.

The highway sections were analyzed segment by segment. Again, the key being that the process was a collaborative one, and all three governments were seated at the table. The consultant team fulfilled the roles of facilitators, technical experts, and resource analysts. The negotiating group included the top-level officials from the three governments. These officials were the Secretary and Deputy Secretary and the Missoula District Administrator from the Montana Department of Transportation, from the Federal Highway Administration, the Division Administrator and Assistant Division Administrator and Environmental Coordinator, and representing the Confederated Salish and Kootenai Tribes were the three Council Members, their lead Attorney and Transportation Planner, as well as other staff members with cultural and natural resources responsibilities.

The collaborative process continued to work very well, and brought about the outcome of negotiating the Memorandum of Agreement (MOA). The Memorandum of Agreement, which was signed December 20, 2000, is an agreement between the Federal Highway Administration (FHWA), the Montana Department of Transportation (MDT), and the Confederated Salish and Kootenai Tribes (CSKT) on how to improve US Highway 93 from Evaro to Polson, Montana. All but a one-half mile segment of the project is located within the Flathead Indian Reservation, the homeland of the CSKT.

The three governments reached agreement on all major design decisions regarding conceptual roadway improvements, including land configurations, design features, and mitigation measures for the highway. This agreement covered 41.4 miles of the 56.3-mile road section; the Ninepipe wetlands complex and the town of Ronan, which is located on the northern edge of the wetlands, were excluded from the discussions and a supplemental EIS was implemented for these areas.

The MOA include five major sections:
- Landscape Architects Design and Alignment Concepts
• Design Guidelines and Recommendations
• Traffic Operational and Safety Report
• Wildlife Crossings Workbook
• Design Components Workbook

The three governments agreed to continue to work together in order to implement the concepts and philosophy established in the MOA.

**Spirit of Place – Understanding the Meaning of a Place**

Jim Sipes, Jones and Jones, Architects and Landscape Architects

In order to be respectful of the land, the people, and the wildlife, six initial goals were established for the US 93 project:

• Develop an understanding of the land and the relationship the Salish and Kootenai people have with the land.
• Find ways the land can shape or influence the road.
• Develop concepts that respect the integrity and character of the place, people, and wildlife.
• Restore habitat areas that have been fragmented by the road and surrounding development.
• Respect and restore the way of life in small communities along the road.
• Create a better visitor understanding of the place that the Salish and Kootenai people call their homeland.

One of the first steps was a review of reports, studies, surveys, photographs, and other documents related to the highway corridor and the natural resources. In addition, an initial reconnaissance of the highway corridor was conducted to identify scenic, aesthetic, and cultural resources. This review and reconnaissance helped build a strong base of knowledge that served as the foundation for subsequent design discussions and decisions.

**Spirit of Place**

Before any design concepts for the road were conceived, it was essential to get a better understanding of the land, what makes it unique, and how the Salish and Kootenai people relate to the land. The design of the reconstructed highway is premised on the idea that the road is a visitor and that it should respond to and be respectful of the land and the Spirit of Place. Understanding the Spirit of Place — the whole continuum of what is seen, touched, felt, and traveled through — provides inspiration and guidance, and leads to design solutions uniquely suited to the special qualities of the place. The Spirit of Place includes more than just the road and adjacent areas; it consists of the surrounding mountains, plains, hills, forest, valley, and sky, and the paths of waters, glaciers, winds, plants, animals, and native peoples. The Spirit of Place encompasses the entire Mission Valley, Mission and Salish Mountains, Jocko Valley, and Rattlesnake Divide. This broader environmental continuum has distinct landscapes like large outdoor rooms, which the existing road bisects.

**Landscapes**

By examining the Flathead Reservation’s big “rooms,” we were able to define 14 landscapes, each with its own unique visual and physical characteristics. These landscapes have visual and ecological qualities that the road must respond to and respect. The informal landscape place references used in the graphic are derived from a dominant landscape feature or characteristic, and from design team and committee input. By looking at these individual landscapes, ideas began to form of how the road should be influenced by, and respond to, the land.

The Pablo Pines landscape, for example, is characterized by pine-covered sand hills that were formed when winds blew down off the glaciers that created Flathead Lake. In this area, a responsive design approach would maintain and restore the pines and rolling character of the sandy hills close to the road. This would also increase the perception that the road is integrated with the land rather than slicing through it. In contrast, the Ronan Spring Creek landscape consists of gently rolling low hills of pasture and cropland, and the road should reflect this rolling, undulating character.

**Cultural and Historic Resources**

One aspect of this project that makes it so unique is that the highway is located entirely within the Flathead Indian Reservation. As a consequence, much of our research focused on the cultural and historic resources of
the area. The CSKT wanted to ensure cultural concerns were addressed in the design alternatives without having to identify individual ritual and sacred sites. After considering several options on how to communicate the cultural importance, the decision was made to associate cultural information with wildlife issues. As a result, discussions about wildlife habitat, wildlife migration, and habitat restoration imparted cultural issues and concerns as well.

Wildlife Crossing Research
In the United States, an estimated one million vertebrates—amphibians, reptiles, birds, and mammals are killed on roads and highways each day. In short, roads have a tremendous impact upon wildlife. American Indians are particularly sensitive to this issue. Since the CSKT recognize the Flathead / Mission / Jocko Valleys are their homeland as well as the homeland for a variety of wildlife, it was important that any new road design allow wildlife to cross the road safely. Roads disrupt natural migration patterns, destroying habitat areas and connections between habitat patches. Due to the impacts of roads, populations of some species have declined dramatically, ecological balance has been changed, and wildlife is being forced into more developed areas where human-wildlife encounters have increased considerably.

By working with scientists and wildlife specialists, we were able to identify habitat areas and migration patterns for specific wildlife. In particular, we looked at road-kill data, tracking information, and sightings to determine where wildlife currently crosses the US 93 corridor. We also were interested in identifying historic migration patterns that have been interrupted by the current US 93. Perhaps it would be possible to restore those traditional wildlife movement patterns if the road was not such a barrier.

We also analyzed current construction techniques for wildlife crossings in order to determine an approach that would work best for US 93. In particular, we studied the wildlife crossings that have been developed for several different highway projects, including the Linn Cove Viaduct (Blue Ridge Parkway, North Carolina), Interstate 70 (Glen Canyon, Colorado), Interstate 75 (Florida), Trans-Canada Highway (Banff, Canada), US Highway 2 (Montana), and State Highway 58 (San Bernadino County, California). (Fish and Wildlife Crossings – Examples of crossing structures, pp.13-17) Various types of crossing structures were evaluated as to their size, cost, design intent, types of animals they are suitable for, the effectiveness of a specific type of crossing, and what animals use the crossings. In doing this evaluation, we could begin to make determinations about which types of crossings are best suited for specific situations along US 93.

Cultural and Historic Resources Wildlife Crossing Research Landscapes
All of this research was incorporated into the design and alignment concepts, and the result was a series of proposed wildlife crossing structures for the entire length of the project. Each individual crossing is presented in greater detail in the Wildlife Crossings Workbook. For many of the wildlife crossing structures to function properly, it will be necessary to use some type of fencing to help control movement and funnel wildlife toward the crossing structure. Eight-foot high page wire fencing designed specifically for wildlife control is recommended for segments of the reconstructed US 93. This fencing is similar to that used for the Trans-Canada Highway in Banff.

Opportunities and Constraints
The inventory and analysis phases of the project lead to the delineation of “Opportunities and Constraints” areas based on the landscape and cultural context. The opportunities and constraints mapping identified zones of opportunity where natural, cultural, and scenic resources can be dodged or only minimally affected by potential highway improvements, and areas of constraint where resources would be adversely affected by highway improvements. This information was used as the basis for developing initial design concepts for the reconstructed road and roadside improvements and visitor amenities.

In order to make the project more manageable, the 14 landscapes were combined into five separate design segments. The five segments are as follows:

- Evaro Design and Alignment Concept
- Arlee to Ravalli Design and Alignment Concept
- St.Ignatius Design and Alignment Concept
- Ninepipe Design and Alignment Concept
- Ronan to Polson Design and Alignment Concept
Design and Alignment Concepts
For each design segment, we explored a wide range of design concepts and recommendations for the reconstructed road. The three governments agreed that all design concepts should be considered unless there was consensus to remove one from consideration. An iterative process was developed for each design segment that consisted of generating the conceptual ideas, reviewing those concepts with the three governments – Federal Highway Administration (FHWA), Montana Department of Transportation (MDT), and the Confederated Salish and Kootenai Tribes (CSKT) – and the prime consultant – Skillings-Connolly, Inc. – and then refining the design concept.

In formulating the design concepts over the length of the road corridor, a decision was made to start on the south end of the reservation at the community of Evaro and proceed north with the concept development. For each of the five design segments, ideas and concepts were generated for road alignment, lane configuration, fish and wildlife crossing structures, wildlife fencing locations, interpretive opportunities, community entry signs, and other roadway features.

In addition to the general recommendations for the five design segments, detailed concepts were developed for specific areas along the corridor where there were special concern. Following is a brief overview of the places where additional focus was needed to address the unique conditions and issues associated with that place.

- The Evaro Hill area is a major wildlife corridor that links the grizzly populations of the Mission Range / Bob Marshall to the Bitterroot grizzly bear recovery zone to the west. How wildlife crossings are incorporated into the road design is critical if wildlife is going to be able to move safely through the area.
- In the community of Arlee, we looked at how a “couplet” could improve traffic flow and safety while maintaining the visual and physical character of the community.
- Ravalli Hill was identified as a possible site for a new visitor center; our concept was to relocate the visitor center to the west of the existing road in order to take advantage of views of the mountains and valley, and to have closer proximity to the Bison Range.
- The Ninepipe area is significant from both a cultural and ecological standpoint. Because of the sensitivity and complexity of the thousands of potholes that make up this rich and diverse habitat, it was imperative to look at the highway within the context of the surrounding landscape. Due to the ecological importance of the wetland complex, the appropriateness of mitigating problems caused by the current alignment came into question. As a result, an alignment that would swing westward around the wetland complex was also considered. Both of these concepts were explored on a conceptual level in order to determine the most appropriate actions for the Ninepipe area, and to see if additional research was needed before final design decisions could be made.

For the community of Ronan, alignment concepts were evaluated for a full range of alternatives, including keeping the new road on existing alignment with some improvements to providing a bypass around the community. In Pablo, a cross-section was developed to accommodate four lanes of traffic while still maintaining the character and identity of the community. For the highway segment between Caffery Road and Route 35, we were concerned with integrating the horizontal and vertical alignment of the reconstructed road with the hilly terrain and maintaining views of Flathead Lake.

Use of Design and Alignment Concepts
These Landscape Architects Design and Alignment Concepts represent a consensus among the three governments – FHWA, MDT, and CSKT – regarding the design direction and standards for the reconstruction of US 93 from Evaro to Polson. What are not shown are the dozens of ideas and concepts that were explored and evaluated. Some of these concepts were quickly discarded, others were revised, discussed, and then rejected, and finally some evolved into the design and alignment concepts contained in this document.

Since it was important that the entire project setting be seen as a whole (Sense of Place Continuum), decision-making was never broken into increments. Final consensus was not sought until design and alignment concepts had been developed for the entire corridor.
A Design Components Workbook was completed to record the spatial location of the components (as recommended in the Landscape Architects Design and Alignment Concepts herein) as well as specific areas for land use control and environmental mitigation identified by the CSKT. Design Guidelines and Recommendations build upon the ideas established in the Landscape Architects Design and Alignment Concepts and are intended to provide landscape architects, designers, planners, engineers, and others involved with transportation-related activities on the Flathead Indian Reservation with a consistent design philosophy and design style.

The Design Guidelines and Recommendations define a collective vision of how the US 93 corridor from Evaro to Polson, Montana will be experienced by both locals and visitors. This document is intended to provide a foundation for the development of a unified and unique identity for U.S. Highway 93 on the Flathead Indian Reservation from Evaro to Polson, MT. The document primarily gives guidance at a conceptual level. It is a starting point for the development of final design details. Although safety and design standards will change over time, every reasonable effort should be made to assure that the spirit of the concepts presented here are manifest in the final design.

The intent of these guidelines is to provide designers, planners, engineers, and others involved with transportation-related activities on the Flathead Indian Reservation with a consistent design philosophy and design style. If the guidelines are used appropriately and follow the design philosophy established for the project, then the result will be that Sense of Place encompasses everything from the basic alignment of the road to the smallest detail of a bridge structure, habitat area, place name sign, or wildlife crossing.

Wildlife Issues Related to the Reconstruction of US Highway 93 on the Flathead Indian Reservation
Dale Becker, Confederated Salish and Kootenai Tribes

The ancestors of the current members of the Confederated Salish and Kootenai Tribes have lived in what is today the northern intermountain region since time immemorial. The day-to-day existence of these people was tied inextricably to the natural resources of this area (Fahey 1974). The abundant wildlife resources provided for subsistence, cultural and spiritual needs of the people. As a result, their lives were intertwined with those of the animals native to the area, and their activities, movements, lifestyle and health depended upon the animals. As a result, wildlife resources play dual roles, being considered as both natural and cultural resources by the Tribes. Even though the Tribes make the Flathead Indian Reservation their homeland today, they also continue to care deeply about their aboriginal territory and the animal inhabitants there. Tribal members also continue to rely heavily upon the wildlife resources, both on and off of the Flathead Indian Reservation.

The proposal for the reconstruction of a 57-mile portion of U.S. Highway 93 located on the Flathead Indian Reservation resulted in consideration of a wide variety of issues and concerns related to wildlife and wildlife habitat (Becker et al. 1993, Becker 1996; Federal Highway Administration and the Montana Department of Transportation 1995). The proposals for various alternative alignments of the highway right-of-way each passed through a diverse array of habitats. As a result, numerous concerns about potential adverse impacts of highway reconstruction related to direct mortality of wildlife, habitat loss and degradation, habitat fragmentation and cultural erosion. The cultural perspective had a direct link to the wildlife issues due to the strong role that wildlife has always played in tribal culture.

The other panel members discussed the technical and design factors from the perspectives of highway design and construction engineering. The details of this project that relate to wildlife and habitat concerns involved with planning for the project are the subject of this paper. The process involved with Highway 93 reconstruction provides excellent examples of some potential pitfalls, problem-solving, innovative thinking, and hopefully useful ideas for other similar projects elsewhere.

The Flathead Indian Reservation
Under the terms of the Treaty of the Hellgate of 1855, the Flathead Indian Reservation was created as a permanent homeland for the Salish, Kootenai and Pend O’Reille people. Under that treaty, the Tribes relinquished ownership to most of Montana lying west of the Continental Divide, as well as portions of eastern Idaho and Washington in return for exclusive use of the lands encompassed within the reservation boundaries to the United States government. Later, allotment of Indian lands, government withdrawals, and finally
opening of the Reservation to settlement resulted in substantial permanent changes to the environment of the Reservation. Those changes continue today, and they relate directly to the Highway 93 reconstruction project.

The Flathead Indian Reservation encompasses approximately 1.25 million acres (505,875 ha.) within its exterior boundaries. The land base is comprised of a wide variety of habitats ranging from semi-arid shrub-grasslands, agricultural lands, diverse wetlands, riparian habitats, and sub-alpine habitats. It consists of four distinct valley complexes bounded by mountains. The primary subject of this discussion is the eastern side of the Reservation, where the exiting and proposed alignments are located. A dominant feature forming the eastern boundary of the Reservation is the Mission Mountain Range, which ranges up to 9,820 feet (2,994 m) above sea level and the Rattlesnake Range to the south.

The dominant land use of the valleys to the west of these mountain ranges is agriculture, predominantly irrigated and dry land farming and livestock production. A significant geological feature is the extensive wetland complex centered around Ninepipe and Kicking Horse Reservoirs. Several small rivers and streams drain into the Flathead River, which bisects the Reservation.

The Reservation provides a diverse array of habitats for a large number of wildlife species. This fauna includes 309 species of birds, 66 species of mammals, 9 species of amphibians, and 9 species of reptiles (Tribal Wildlife Management Program, unpublished data).

Direct Wildlife Mortality Issues
Wildlife utilize the entire Highway 93 corridor on the Reservation, as indicated by observations and by the number of road-killed deer, bears, turtles, small mammals, non-game and game birds and other species that one observes within the right-of-way each day. There are, however, a number of areas that receive higher levels of wildlife use than others and exhibit a corresponding increase in vehicle-related wildlife mortality. To analyze the severity of mortality, logs of Tribal conservation officers and Montana Department of Transportation maintenance personnel were reviewed. In addition, incidental observations of Tribal Wildlife Management Program staff members were reviewed. Pertinent observations of Tribal Elders and other local people were also sought.

This effort assisted with the preparation of maps of the entire highway route with areas of high and repeated wildlife mortality problems designated. In addition, an analysis of habitat features, such as vegetative cover and hiding cover indicated where animals might be expected to attempt to cross the highway. As an example, at one section of the highway, the Evaro area, these factors in addition to winter tracking data and other wildlife survey results assisted with the determination of areas most likely to be used as wildlife crossings by wildlife. In addition, remote-sensing cameras placed near wildlife trails provided added insight about the numbers and species of animals using the trails (Becker et al. 1993). Collectively, the information provided by these methodologies assisted in indicating where animal use was occurring and the degree of that use.

Big game mortality was somewhat random, but tended to be linked closely to the habitat features adjacent to the right-of-way. Most deer and bear mortality was linked to adjacent riparian areas or other forested cover types. Deer were also killed in open agricultural habitats, but this mortality generally occurred near adjacent cover.

The Flathead Indian Reservation hosts four terrestrial species listed as endangered or threatened by the U.S. Fish and Wildlife Service – the grizzly bear (Ursus arctos horribilis), the northern gray wolf (Canis lupus), the bald eagle (Haliaeetus leucocephalus), and the Canada lynx (Lynx canadensis). At the time of the onset of the environmental analysis for this project, the peregrine falcon (Falco peregrinus) was also listed. Additionally, during the period since the analysis began, the bull trout (Salvelinus confluentus) has been listed.

Although Highway 93 passes through habitats used by each of these species, the only known mortality of a listed species known were a sub-adult female grizzly bear, killed by an automobile in the Ninepipe Reservoir area in 1999, and a sub-adult female grizzly bear killed in 2001 near the same area. Other mortality of listed species may have occurred, but no records of these exist.

The Ninepipe-Kicking Horse Wetland Complex exhibited a high level of wildlife mortality of wildlife, with nearly every local species represented as a road-kill at least once. Of particular significance was the high mortality
rate of western painted turtles each summer. Conservative estimates of this mortality were a minimum of 300 per year, based upon direct counts of road-killed animals (Tribal Wildlife Management Program, unpublished data). Numbers of some avian species, particularly passerines, waterfowl, shorebirds and raptors, which inhabit the natural and borrow pit wetland habitats adjacent to the highway, was also a concern. Several species of small to medium-sized mammals were also regularly killed by traffic on the highway in this area. The segment of the planned reconstruction project in this area is still undergoing study due to continuing unresolved issues among the three governments – the Confederated Salish and Kootenai Tribes, Montana Department of Transportation and Federal Highway Administration) - on alignment of the highway through the area.

Wildlife Habitat Issues
Wildlife habitat issues were grouped into two categories – habitat loss or degradation and habitat fragmentation. Habitat loss was anticipated within the right of way and immediately adjacent to it in areas where construction activities are planned. Habitat degradation is more subtle and harder to document. The fact that the highway will largely follow the existing right-of-way will limit habitat loss to some degree, although wider rights-of-way will result in some additional loss of adjacent habitats. With regard to wetland and riparian habitats, the Tribes’ Wetland Conservation Plan (Confederated Salish and Kootenai Tribes 2000) requires that impacts be avoided whenever possible. If these impacts are unavoidable, mitigation will be undertaken to replace or restore a given amount of wetland habitat.

Habitat fragmentation has already occurred with the existence of the highway in its present configuration and alignment. The amount of traffic on the highway and the lack of any substantial existing wildlife crossing structures results in fragmentation of adjacent habitats, be they grassland, wetlands, riparian or forest habitat. This fragmentation is indicated by the fact that wildlife is being killed on the highway as animals attempt to cross the right-of-way.

Mitigation Proposals

Mitigation for Wildlife Mortality
The sites of documented wildlife mortality, especially multiple recurring mortality, indicate the location of many, if not most wildlife passage problems. To alleviate these problems to the greatest extent possible, a number of different design features are being included in the reconstruction plans for Highway 93. Collectively, these design features will be utilized to both decrease the amount of wildlife mortality caused by traffic on the highway, as well as to mitigate for the habitat loss, degradation and fragmentation that currently exists.

Crossing Structures
The plans for the reconstruction of the highway will include construction of 42 metal pipe culverts or concrete box culverts of a design that will facilitate wildlife crossing the highway. Seven bridges, ranging from 40 to 400 feet (12-120 m) in length and a minimum 12 feet (3.5m) of height clearance to facilitate wildlife passage and re-vegetation will be constructed across the larger rivers and streams that bisect the highway. Finally, one over-crossing structure with a width of 150 to 200 feet (45-60m) will also be constructed. These plans were developed under the Memorandum of Agreement between the Tribes, the State of Montana and the Federal government (Montana Department of Transportation, Confederated Salish and Kootenai Tribes and the Federal Highway Administration 2000). Each of these structures will be designed and placed to ensure wildlife passage opportunities across the highway right-of-way by a variety of the local wildlife species. Many of the concepts for these structures and those discussed below were originally developed elsewhere, but the specific locations and concerns locally, in addition to more recent ideas and data from similar structures will likely dictate some changes in design features.

Drift Fencing
Plans for mitigation of wildlife mortality also include construction of 8-foot (2.5 m) high page mill wire fencing with wing fencing at terminal locations to accompany the crossing structures described above. The fencing will be placed to encourage wildlife movement toward the crossing structures. In areas in which burrowing or digging animals are a concern, extension on the lower sides of the fencing will be added and buried to discourage breaching of the fencing.
Signing
Informative signing will take two forms – signs to warn motorists of potential wildlife hazards and signing to inform motorists of wildlife crossings. Warning signs will alert motorists regarding potential wildlife hazards in the highway right-of-way. Informative signing will assist motorists in learning about the presence of wildlife crossing structures, as well as the rationale for their construction.

Wildlife Escape Structures
Regardless of the presence of wildlife crossing structures, it is inevitable that wildlife will occasionally enter the right-of-way. To deal with such situations, wildlife fencing will be constructed to assist wildlife in moving away from the highway toward jump-out structures that will allow them to exit through the fencing and leave the right-of-way. These types of structures have been installed elsewhere and have exhibited use and success by big game animals.

Monitoring and Research – Because of the number and types of wildlife crossing structures anticipated for this project and the need to evaluate the utility and degree of use of the various designs an extensive monitoring effort is being developed. Several opportunities for research to assess the use of the structures by wildlife and their impact upon wildlife use will be possible. The three governments, academic institutions and other entities to achieve the greatest degree of knowledge possible will coordinate research and monitoring efforts.

Mitigation for Habitat Loss or Degradation
The primary habitat mitigation associated with the proposals for the reconstruction of Highway 93 is associated with anticipated loses of wetland habitat due to construction activities. The Confederated Salish and Kootenai Tribes’ Wetlands Conservation Plan (Confederated Salish and Kootenai Tribes 2000) outlines an approach that preserves and mitigates for adverse impacts to wetland and riparian habitats. This plan established a goal of halting the loss of the remaining wetland and riparian habitats and the decline in wetland and riparian quality on the Reservation. The long-term goal of the plan is to increase the acreage of wetlands and riparian areas and improve the quality of these habitat resources. It outlines a strategy for conservation and mitigation of adverse impacts upon wetland and riparian habitats, as well as procedures to address these issues.

Habitat fragmentation is a constant concern on the Flathead Indian Reservation, and fragmentation due to land uses, highway and road construction and subdivision activities are major issues (Confederated Salish and Kootenai Tribes 1994, 1996). The Tribes’ concerns related to these issues have a direct bearing on the Highway 93 Reconstruction project. As a result, the Tribes utilize a variety of policies and planning tools on Tribal lands manage human growth pressures, habitat degradation issues and highway construction impacts and subdivision pressures. Because much of the Reservation consists of non-Tribal lands, the Tribes also work closely with other appropriate governmental agencies at the local, county, state and federal levels in an attempt to decrease the adverse impacts of some of these activities upon Tribal resources.

Conclusions
The planning effort for the reconstruction of U.S. Highway 93 through the Flathead Indian Reservation has been a long and arduous task that continues toward resolution. The insistence of the Tribes that the highway be designed as a safe and environmentally friendly road instead of other potential alternatives sets the stage for a new vision for future highway designs. Ongoing activities occurring elsewhere indicate that the ability and innovation to actually do something positive for wildlife and habitat in designing a highway is both possible and practical. These activities are certainly preferable to merely paving a sterile right-of-way over the shortest route between two points and allowing the impacts of such an approach to occur. As a result, possibilities for designing and building a highway that lays well on the land and assists in solving many of the attendant environmental issues seem to be at hand with regard to the U.S. Highway 93 reconstruction project.

MOA and Context Sensitive Design
Dale Paulson, Federal Highway Administration

You have now heard our story of US 93 and the wildlife protection measures designed into what we hope will be a successful project. For those of you who would like more information of the Memorandum of Agreement (MOA), it can be found at www.skillings.com; go to Current Projects, click on Montana, then select US 93 MOA.
Where do we go from here??
Starting right now, with the completion of the reevaluation of the EIS, designs are beginning. We hope to have designs complete by the end of next year and rights-of-way done so construction can begin in the spring of 2004, two-and-one-half years from now. As for the wildlife protection measures, we hope to start some baseline monitoring this coming year. Funding for that is still up in the air, but Western Transportation Institute (WTI) has taken the lead. They have put together a very good plan on the possibilities for a complete study. Our hopes are that this monitoring effort will lead to some BMP’s that can be used elsewhere in Montana and the nation. I hope that at future conferences we will be able to report on the knowledge that we have gained from this joint effort.

ICOET (The MOA and Context-Sensitive Design)
The previous speakers have discussed cultural, technical and design features of the US 93 project, now let’s discuss how the MOA ties the process together to develop a project that will be sensitive to the context of the area. Cooperation between FHWA, MDT and the Confederated Salish & Kootenai Tribes resulted in an MOA that sets forth concepts that will facilitate streamlining the development and construction of US 93 through the Flathead Indian Reservation.

A major element for success was developing a project that benefits all of the stakeholders. The improvements in the US 93 corridor include measures that increase vehicular safety, reduce congestion, respect culturally significant areas, allow wildlife passage and maintain the nature and spirit of place. In engineering language this is context-sensitive design. Context-sensitive design (CSD) has gained broad acceptance in the transportation community. It involves understanding the “context” through which the transportation facility travels, and developing a design that responds to that context.

The MOA’s context-sensitive design approach resulted in guiding principles for developing a carefully and imaginatively designed project that serves traffic demand, is safe, respects the natural environment and is viewed as an asset by those that use it. On January 14, 2001, shortly after the MOA was signed, the Missoulian, a local paper carried a feature story headlined as “US Highway 93 Expansion” - “Kinder gentler project.” This headline illustrates that the context-sensitive design objectives envisioned by the MOA are well on their way to being achieved.

The MOA is just the beginning of the process. From here, the process will include environmental analysis, design, public involvement, resolution of right-of-way issues, funding procurement and construction of the project.

A re-evaluation of the EIS, which includes public involvement, will soon be completed and a supplementary EIS is underway for the section of the corridor that includes the Ninepipes wetland complex. The Supplemental EIS will address significant issues that include the listing of additional endangered species and a heightened awareness of extensive cultural and environmental issues unique to the Ninepipes area. The SEIS will specifically explore alternatives to the current alignment that could skirt the most densely populated pothole portion of the Ninepipe glacial pothole wetland complex. The document will also address the social and economic impacts that will result from proposed new alignments. The SEIS scoping process quickly revealed that changing the alignment would be controversial.

Nine consultant design contracts are planned for the portions of the corridor covered by the EIS re-evaluation. The three governments established a Technical Design Committee (TDC) to oversee the work of the consultants. The TDC consists of three permanent representatives, one appointed by each government, and of temporary representatives that may from time to time be invited to participate by the TDC’s permanent representatives. The TDC may invite other representatives from Missoula County, Lake County, the City of St. Ignatius, the City of Ronan, the City of Polson, the Montana Department of Fish, Wildlife, and Parks, or the U.S. Fish and Wildlife Service, to join the TDC when US 93 improvements are within their jurisdictional area. The TDC’s purpose is to oversee the development of the project to insure that it is developed in accordance with the MOA.
Research is also an essential element of this project. If approaches to wildlife crossings along US 93 are found to be effective the results may have a broad application and could result in a toolbox of best practices for many projects in the Northern Rockies. The US 93 corridor is an excellent laboratory for implementing wildlife strategies because of the ecosystem and the 56-mile length of the corridor. This project is similar in context to many other locations and lessons learned will be easily adapted to other projects.

In order to accelerate the actual construction of improvements to the corridor, MDT intends to use its existing bonding authority to generate $125 million to be repaid with future Federal-aid apportionments through use of the Garvee bonding provisions. Using this innovative financing tool, MDT hopes to proceed as quickly as possible into construction on this extremely important corridor.

Finally, remember that context-sensitive design is a collaborative interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic, cultural and environmental resources while maintaining safety and mobility. CSD is an approach that considers the total context within which a transportation project exists.

**References**


PROACTIVE, STATE-BASED, INCENTIVE-DRIVEN POLICY FOR HABITAT CONSERVATION

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Abstract: America's economic prosperity depends, in part, on an effective, efficient highway system. America's ecological health depends in part, on an effective, efficient habitat system. Highway and habitat needs have often been in conflict in the past. Without more proactive efforts to integrate these two needs, such conflicts are likely to increase in the future. This need not be the case. Ecologists and conservationists in several areas of the country have identified networks of habitat areas that, if adequately conserved, would provide room in the regional landscape sufficient to conserve its native biodiversity. Integrating such habitat conservation plans into the earliest phases of transportation planning can help identify ways to avoid highway and habitat conflicts long before significant resources have been irretrievably committed. Where highway and habitat needs cannot be resolved through more integrated planning alone, minimizing impacts through engineering solutions, or off-site mitigation of habitat destruction can assure that our transportation and habitat systems evolve together to the benefit of both. This paper presents a four-part federal policy to achieve this objective.

The Endangered Species Act of 1973 (ESA) has proved to be a landmark in conservation efforts. It has led to a new respect for the diversity of life and has been the foundation of remarkable conservation successes. But the list of threatened and endangered species has grown steadily over the past two decades; from 178 in 1976 to 1235 as of November 2000 (Http://www.endangered.fws.gov/wildlife.html). Another 5000-6000 species may eventually need to be listed (Stein 2000). Clearly, we are not doing enough to adequately address the underlying cause of species endangerment. Eighty-five percent of currently listed species and those likely to require listing in the future are in that condition, at least in part, because of the continuing loss of natural habitats (Wilcove 2000). A pro-active, state-based, incentive-driven policy for the conservation of key habitats, outlined here in broad concept, could complement the existing ESA and help develop a nation-wide system of habitat conservation areas that could maintain our native biodiversity and lessen the need for Federal regulatory intervention in the future.

Lessons Learned

Twenty-five years of implementing the ESA have provided valuable lessons that should be reflected in a new habitat-focused policy initiative to conserve biodiversity. The principal lessons are scientific, political, and economic.

Science has taught us that the underlying threat to biodiversity is the loss of habitat. Eighty-five percent of species currently listed as threatened or endangered are in that condition, at least in part, because of the loss or degradation of habitat (Wilcove 2000). Science has also taught us that waiting to take conservation action until a species is listed minimizes the chances of long-term viability (Shaffer 2001). Because options are limited when a species’ habitat is greatly reduced, continuing habitat loss also tends to maximize the costs of conservation. Maintaining the full array of plant and animal species and natural communities is going to require the protection of a large amount of habitat, and much of that habitat is on privately-owned land (Shaffer 2001).

The politics of the ESA has taught us that a strictly regulatory approach to achieving protection of a sufficient amount of habitat is politically controversial and unlikely to be as successful as needed in the current political climate. Although the ESA provides some regulatory flexibility through its habitat conservation planning (HCP) provision, this approach often falls short because it is generally targeted at individual species, and because the standards for approval are too low to encourage recovery, let alone adequately protect other species or the overall ecosystem (Hood 1998).

We have also learned that a strong law can be seriously weakened by its annual appropriation. Congress has failed to provide the Fish and Wildlife Service with funding sufficient to attain the ESA’s goal of species recovery (Scott 2001).
Economics has taught us that non-regulatory, incentive-based programs that do not involve fee simple acquisition can promote the use of land for conservation purposes (Fischer 1993; Vickerman 1998; Casey 1999; Shogren 1999; Brown 1999). Examples include land retirement or cost-sharing of stewardship practices through the U.S. Department of Agriculture’s (USDA) Conservation Reserve Program (CRP), Environmental Quality Incentives Program (EQIP), the Wetlands Reserve Program (WRP), and the Wildlife Habitat Incentives Program (WHIP) (Libby 1998; Boyd 1999).

To date, the lessons from these different disciplines have too often been pitted against each other. If species need more habitat protection than current regulation is producing, then some believe the regulations should be strengthened. Because regulation is unpopular with some constituencies and land acquisition is expensive, others want to believe we can get by with less conservation land. And, because the costs of effective conservation loom larger than our historic level of investment in these resources, some believe we can’t afford it.

Greater progress in achieving the effective conservation of our nation’s biodiversity heritage requires that society accept these lessons, and formulate a habitat conservation policy that reconciles the legitimacy of each. Saving biodiversity at all its levels (genes, species, communities, ecosystems) will involve protecting a significant portion of the American landscape from intensive development, but not the whole landscape. Achieving the necessary scale of habitat protection through regulation alone is not the only option. The economic costs of large-scale habitat protection are large when viewed through the lens of immediate acquisition, but not every acre must be bought, and not all at once. In fact, many lands currently managed primarily for purposes other than conservation, especially low intensity agriculture, forestry and recreation, provide important conservation values that could be maintained or even improved with application of the right management techniques.

**Principles of a New Policy Initiative**

National biodiversity conservation policy should complement the strong regulatory protections of the ESA with a new program for habitat conservation based on the lessons learned to date. Such a new habitat program should be proactive, state-based, and incentive-driven.

**Proactive**

Biodiversity conservation efforts are likely to be more successful and less expensive if we design and protect adequate habitat conservation areas before species become threatened or endangered. If we do so on a biologically comprehensive basis (all natural community types and all at-risk species), and in accord with emerging principles for the long-term viability of such systems (Shaffer 2000), then we should be able to preempt the future endangerment of thousands of species. Designing and implementing such systems of habitat conservation areas would also provide opportunities for better addressing the habitat needs of currently listed species and providing a common framework for recovery efforts on their behalf.

An important corollary for a proactive approach is integration. Integrated conservation strategies that address both terrestrial and aquatic ecosystems simultaneously will be more successful in the long run because both are impacted by human activities across the landscape. And, if habitat needs are addressed within a broader context along with water quality, flood control, transportation systems, growth management, and outdoor recreation, the probability that biodiversity is likely to receive adequate attention will be improved.

**State-Based**

A prevailing trend in American politics is placing more authority and discretion for the achievement of social goals with the States. This pattern is evident, for example, in the implementation of federal air and water quality statutes. While maintaining a strong federal ESA is essential as a fail-safe mechanism, there are sensible ways to empower the states to play a greater leadership role in biodiversity conservation that, over time, could lessen the need for federal regulatory intervention. Moreover, as Wilkinson (Wilkinson 1999) points out, the traditional role of States with regard to wildlife and other public trust resources, and their role in the land-use decision-making process means the States are essential players in habitat conservation efforts.

Although State government can still seem far removed from local communities, it is a step closer than the federal government, and States could, where appropriate, empower local governments to work together to
formulate coordinated local habitat conservation strategies that could, collectively, produce a comprehensive state-wide effort. States can also facilitate and support regional efforts to develop and implement integrated conservation strategies like the ones currently underway for the Chesapeake Bay, the Bay Delta in California, the Sonoran Desert in Arizona, and the Willamette Basin in Oregon.

**Incentive Driven**
Under our form of government, wildlife (mammals, birds, reptiles, amphibians, fish, etc.) is considered a public trust resource not subject to private ownership. At the same time, most habitats, other than navigable waters, that are home to these species have no equivalent public trust status. The net result is that the public trust often depends critically on habitats that occur on private land. Land is a commodity traded in the free market, and government prohibitions of certain land uses to protect habitat can diminish the financial value of that land to the owner. On the other hand, one individual’s decision to alter habitat could extinguish a species and irreversibly diminish the rights of other citizens and future generations to the full benefits of the public trust. Thus, no matter how we look at it, the conservation of endangered species and overall biodiversity requires the balancing of legitimate but sometimes competing interests.

To date, the ESA has relied on a primarily regulatory approach to balance these interests. But regulation is only one of several tools for achieving endangered species and biodiversity conservation goals.

**The Essential Elements of a National Habitat Conversation Policy**
Translating these principles -- prevention, state-based, incentive-driven -- into concrete policy initiatives is easier to envision than to achieve. But the nation could have a habitat conservation policy that embodies these principles through the expansion and coordination of existing programs. Three elements are essential: a plan or strategy, a menu of incentives, and the coordination of these efforts with future highway development.

**State Habitat Conservation Strategies**
Congress and the Clinton Administration took a giant step toward enabling an improved habitat conservation policy last fall. The FY 2001 Interior and Commerce Appropriations bills designated a new state wildlife funding program that, among other things, now encourages and supports States to undertake the development of comprehensive, state-wide habitat conservation strategies. Such strategies are expected to identify and map those land and water areas essential to the long-term conservation of the state’s at-risk plant and animal species, and natural communities. Such plans or strategies have already been completed in Florida (Cox 1994) and Oregon (Defenders of Wildlife 1998), and these efforts can serve as models for other States.

Based on the experience of Defenders of Wildlife and our partners in Oregon, these strategy development efforts will be most useful if they are multi-sector (public and private), multi-agency (wildlife, forests, agriculture, transportation, etc.), and multi-jurisdictional (state, local, and federal).

**Habitat Conservation Incentives**
Public lands–especially federal and state lands–are the logical starting point for providing the habitat necessary to support the public trust of biodiversity. Enhanced multi-agency coordination and planning can assure that the public gets the most biodiversity value from the very significant investment it has already made in our public lands. Nevertheless, nearly 40% of at-risk species are not known to occur on federal lands which constitute the vast majority of public lands (Cox 1994). For other species, the habitat that existing federal lands provide is not enough to assure their viability because 67% of populations of threatened and endangered species exist on non-federal lands (Groves 2000). Consequently, many important habitat conservation areas will be, in whole or in part, on private lands.

There is a need for new incentives to promote habitat protection on private lands, either permanently, or as an interim step until acquisition is feasible. A national habitat conservation policy should address this need in two ways: first, through the enhanced and streamlined provision of information, and second, by the provision of new incentives for the voluntary conservation of habitat areas identified by the States in their comprehensive habitat conservation strategies.
Information
The federal government could provide funding to each State to establish a “Habitat Conservation Ombudsman’s Office.” Such offices could provide one-stop shopping for landowners wishing to take advantage of Federal, State, and local incentive programs that might be used to conserve biodiversity habitat. Such offices could also, over time, provide feedback to Federal, State, and local policy-makers on how existing landowner incentive programs for natural resource management are working at all levels, and how they could be improved and better coordinated to more effectively conserve habitat conservation areas.

Incentives
A more effective national habitat conservation policy also needs to provide a menu of flexible incentives to private landowners whose lands lie within the habitat conservation areas identified in their State’s habitat conservation strategy. Incentive options should recognize that the social and economic factors that influence a landowner’s habitat conservation decisions are not the same for all landowners, or in all parts of the country. There is no “one-size-fits-all” approach to conserving habitat.

Table 1 provides a menu of incentives to meet two different habitat conservation needs: natural habitat protection and habitat management activities, including restoration. Natural habitat protection is simply leaving lands in habitat conservation areas identified in a State’s habitat conservation strategy in their current natural or near-natural condition. Habitat management activities refer to such things as the control of exotic species, and the return of ecosystem processes, such as fire, that are essential to maintaining or restoring habitat conservation areas as identified in each State’s habitat conservation strategy.

Funding for direct habitat conservation payments could be accomplished either through amendment of one of the existing conservation titles of the farm bill (e.g., CRP, WHIP, etc.), or creation of a new habitat protection program.

Table 1 also includes preferential tax treatments that could be established through amendment of the federal tax code to provide an alternative set of incentives to landowners not normally involved in agriculture, or whose primary limitation on participating in habitat conservation is related more to tax considerations than to the availability of funds. Also included are tax incentives for the sale of lands in habitat conservation areas to qualified public or private conservation buyers.

Table 1
Possible incentives to promote the voluntary conservation of privately owned land in habitat conservation areas identified in state-wide habitat conservation strategies.

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<tr>
<th>Direct Payments</th>
<th>Preferential Tax Treatment</th>
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<td>2. Cost-share of habitat management activities (e.g., control of exotics, prescribed burning, etc.).</td>
<td>2. Estate-tax exclusion for value of lands in natural habitat protection.</td>
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<td></td>
<td>3. Federal income tax credit in amount of local property taxes for land in natural habitat protection.</td>
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<td>4. Cost-share federal income tax credit for habitat management activities.</td>
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To qualify for the above incentives, other than the capital-gains exclusion, the landowner would enter into a written agreement with a State-designated habitat conservation authority, or, if no such authority is designated, with USDA/NRCS, affirming that the landowner will keep the identified lands in a use compatible with their identification as habitat conservation areas, or, where applicable, undertake habitat management activities deemed necessary under the State’s habitat conservation strategy. To encourage participation, the minimum term for such agreements could be five or ten years, with the option of a permanent agreement.
Each State would need to establish a system for enrollment and for certification that the relevant habitat has been conserved and/or management activities undertaken.

Such a menu of incentives could start to change the underlying dynamic of land conservation for biodiversity. Whether these incentives would prove equal to the task is an empirical matter, and Congress could include in any authorizing legislation the authority and funding to assess their efficacy at some suitable point (five or ten years) in the future. They were selected based on a common-sense appreciation of the cost structure of land ownership and management, the fact that many of these incentives have been identified as potentially useful instruments in previous studies (Fischer 1993; Keystone Center 1995; Vickerman 1998), and the fact that Congress has in the past, or currently is considering several of these incentives in some form.

These policy changes would necessitate providing additional resources for the Natural Resources Conservation Service, the U.S. Fish and Wildlife Service and state designated lead and support agencies for program implementation and monitoring.

**Habitat and Highway Coordination**

Sprawl development is second only to agriculture as a leading cause of habitat destruction and alteration (Wilcove 2000). Although many types of infrastructure (bridges, dams, power-lines, etc.) have an impact on habitat, highways are the most important because they are the leading edge of development. National transportation policy has many consequences for our nation’s efforts to maintain a safe, healthy and productive environment, including the maintenance of sufficient habitat to sustain our native at-risk species and natural communities. Because a more comprehensive national habitat conservation policy would provide major federal resources for voluntary, State-based habitat conservation efforts, it is important that such a national policy also address coordination of other federal expenditures that could impact the prospects for the success of the States’ efforts.

At present, few States have general habitat conservation strategies, and those that do have little direct control over federal actions that might negatively impact their efforts. That need could be addressed through earlier and more informed coordination of federal expenditures on surface transportation with State-based habitat conservation strategies, and through expanding the concept of mitigation currently applied to wetland habitats to apply in the future to a State’s overall system of habitat conservation areas.

Enhanced coordination could be accomplished through the use of State habitat conservation strategies at the initial stages of the transportation planning process. Utilization of this habitat mapping data can serve effectively as an early warning system to identify projects with major wildlife impacts.

In recent years, Congress has expressed a great deal of interest in reducing environmental review times through what it refers to as “environmental streamlining.” Simply put, streamlining is an effort to avoid unnecessary delays in the development of highway projects caused by the environmental review process. Comparing proposed highway projects with the State’s comprehensive habitat strategy should reduce project delays and yield greater natural resource protection. A leading cause of project delays is insufficient understanding of resource impacts, especially relating to wildlife, resulting in protracted litigation. Such a review of highway plans in light of a State’s habitat conservation strategy would help identify many of the most controversial projects – ones likely to have the longest average approval times – at a time when the number of options for addressing environmental concerns is the greatest.

Some States are already beginning to recognize the advantages of more closely coordinating highway construction plans with natural resource mapping data. The Florida Department of Transportation, for example, is working with local governments to implement an environmental screening analysis to address secondary and cumulative impacts. The analysis consists of a 12-part questionnaire focused heavily on natural resource mapping data compiled by various agencies, including the Florida Fish and Wildlife Conservation Commission. While the primary goal of this process is to encourage more effective mitigation, the process could also be helpful in discouraging local governments from pursuing especially damaging projects. Using this type of early warning process to weed out the small number of highly damaging and litigation-prone projects should yield both significant environmental benefits, and help address streamlining concerns. A review (Smith 1999) of the application of this screening process to proposed road projects...
throughout Florida identified a mere 38 projects with highly ranked ecological conflicts. This represents an extremely small percentage of highway projects proposed statewide but, in all likelihood, a high percentage of projects that will be subject to extensive delays due to environmental concerns.

Biodiversity is our “green” infrastructure, providing important public services (carbon sequestration, oxygen generation, water filtration, etc.) not unlike the “grey” infrastructure of roads, bridges, water systems, etc. The public gains little if its investments in one type of infrastructure negate its investments in the other. Highways and conservation have often been in conflict in the past, and will often be in conflict in the future. The first step toward minimizing such conflict is to recognize the importance of both types of infrastructure and to coordinate planning the adequate provision of each. State-based comprehensive habitat conservation strategies can be critically important to informing long-range transportation policy and planning, stream-lining environmental review and permitting, and expanding the concept of mitigation to the full system of habitat conservation areas. But for these state-based habitat conservation strategies to lead to the systems of habitat conservation areas necessary to maintain our green infrastructure, they must be supported by a transportation and overall infrastructure policy that recognizes their value to society.

Summary
By the midpoint of the 21st century the population of the United States is expected to increase by at least 50%. If that increase takes place in the absence of more focused, effective, and proactive means of identifying and protecting a comprehensive system of habitat conservation areas, our native biodiversity resources are likely to be severely and irreversibly diminished. Upwards of 5,000 additional species may have to be listed as threatened or endangered, and a good many may become extinct, if not in our lifetimes, then in our children’s. This need not be the case. We are still sufficiently wealthy in natural resources that conservation and development are not alternative choices we must make, but widely shared values we can blend and balance. Wisdom can still make a difference. We are also sufficiently experienced in our practice of conservation to have a general sense of what works best in our society. Adding a proactive, State-based, incentive-driven policy for habitat conservation will allow us to apply our collective wisdom to meet the need we still face—securing the place of nature’s diversity in the American landscape.

Biographical Sketch:
Dr. Mark Shaffer is the Senior Vice President of Programs at Defenders of Wildlife. He supervises Defenders’ habitat conservation, species conservation and law and litigation activities, and a growing regional staff in eight states.

Dr. Shaffer has extensive experience in conservation biology, population viability analysis, and resource economics both as a governmental and non-governmental participant. He has served as consultant for federal and state agencies on various endangered species issues including protection of the grizzly bear, California condor, black-footed ferret and northern spotted owl. He is also widely published in the conservation biology literature.


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Http://www.endangered.fws.gov/wildlife.html


PROMOTING ENVIRONMENTAL STEWARDSHIP IN NEW YORK STATE DEPARTMENT OF TRANSPORTATION

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Abstract: The New York State Department of Transportation (NYSDOT) is firmly committed to a proactive environmental ethic in providing a safe, efficient, balanced and environmentally sound transportation system in the State of New York. In building and maintaining a statewide transportation network, NYSDOT must balance many competing needs while ensuring the people of the state a safe and efficient system. New York State Department of Transportation has taken steps to fully integrate environmental concerns into their normal work, from planning and scoping right through design, construction, operation and maintenance by instituting its environmental stewardship program, the Environmental Initiative. This Initiative includes conducting maintenance, equipment management and construction activities appropriately to prevent and/or minimize adverse impacts upon the environment and to enhance the environment when we can. This paper describes how the operational capabilities of a Department of Transportation can be brought to bear on the environmental stewardship responsibilities shared by all governmental organizations.

Introduction
Historically, transportation agencies have progressed their capital programs in a way that ensures strict regulatory compliance. However, they seldom went above and beyond compliance. Though this reactive approach served to reduce unnecessary environmental damage, it did little to improve the environment.

It is the responsibility of all state agencies, not just that of the environmental agencies, to protect the environmental resources within the state. As New York’s largest public works agency, NYSDOT recognizes its potential and opportunity to proactively advance the State environmental program. NYSDOT has affirmed its obligation and responsibility to the people of New York to protect, improve and enhance the environment as opportunities arise, especially when this can be done for little or no additional cost.

To address this obligation, NYSDOT developed an Environmental Initiative in the spring of 1998. Through proactive actions, NYSDOT has become an important part of New York State’s environmental solution and has changed its working relationships with environmental agencies and groups. As these agencies and groups have become partners, permit approval times have improved, mitigation costs have declined, morale has improved and cost-effective environmental benefits are being realized.

By progressing the philosophy of environmental stewardship and promoting an environmental ethic, NYSDOT has moved beyond the conventional reactive regulatory approach to that of protecting and enhancing the environment. The Environmental Initiative is a paradigm shift applicable to all Public Works Agencies.

Background
New York State Department of Transportation is the state’s largest public works agency. As such, the Department recognizes its obligation and responsibility to the people of New York State to protect, improve and enhance the environment in the course of its business of planning, building and maintaining a transportation system. Environmental stewardship builds on the values of the Department’s employees to protect the natural and cultural resources of the state. Caring for the environment while providing a transportation network allows DOT employees to feel positive about being “good neighbors” that a community can welcome rather than shun. Environmental stewardship builds credibility, trust, and good will as well as building staff enthusiasm and morale.
Overview of NYSDOT'S Environmental Stewardship Program
NYSDOT's Environmental Initiative began in April 1998 with the creation of the Environmental Initiative Statement (See http://www.dot.state.ny.us). Following some kickoff activities throughout the summer of 1998, Governor George Pataki formally announced the Initiative on October 20, 1998. Since that time, NYSDOT has undertaken deliberate actions, developing goals and objectives, and adopting a much more proactive approach to addressing environmental matters.

Objectives
NYSDOT's Environmental Initiative has five major objectives:
- Promote and strengthen an environmental ethic throughout the Department.
- Advance State environmental policies and objectives with NYSDOT resources.
- Partner with others to construct environmental enhancements.
- Pilot new environmental protection and enhancement methods.
- Strengthen relationships with environmental agencies, organizations and local municipalities.

Action Plans
Each of the eleven NYSDOT Regions and Main Office Functional Units have been directed to prepare an action plan for their program to address the Environmental Initiatives' major objectives. The regional and program-specific action plans identify:
- Planned tasks to advance each of the five major objectives.
- Individuals/groups that are primarily responsible for implementing each action.
- Groups/program areas that will provide the necessary assistance.
- Target completion date.
- Actual completion date.
- Reporting mechanisms.

Integration with Other Initiatives
The first phase of the Environmental Initiative, as described in McVoy, et al., 2000 (1), has been considered a success. NYSDOT has gone beyond the original concept of the "Initiative" to adopt an overarching stewardship approach, whereby the Department's Environmental Ethic integrates and progresses other concepts such as Context Sensitive Solutions, Quality Communities, public outreach, and an expanded appreciation of what we see around us. The environmental ethic has permeated into the planning, design, construction, maintenance and operations of transportation systems. The Department is now doing business differently instead of progressing a new concept. The Environmental Ethic is more than a vocabulary change or a volunteer effort – it is a paradigm shift and an integral part of DOT procedures.

Agency managers are strongly committed to the idea, and business leaders are coming to see it as a positive way to promote business in New York rather than just another street torn up by construction. Our “customers” in the communities and regulatory agencies such as the NYS Department of Environmental Conservation and Office of Parks, Recreation and Historic Preservation have now come to expect this of NYSDOT. They are learning to view NYSDOT as a partner in a joint effort to enhance the environment rather than as an agency that needs to be carefully watched and regulated.

Progress on NYSDOT'S Environmental Stewardship Program
NYSDOT assesses progress on its Environmental Stewardship Program in four categories: Leadership, Implementation and Monitoring, Partnerships, and Results.

Leadership
NYSDOT has shown leadership in progressing environmental stewardship by:
- Establishing agency-specific environmental goals.
- Adopting a mission statement that reflects an environmental stewardship ethic.
- Issuing an official statement from executive management endorsing an agency-wide environmental stewardship ethic (http://www.dot.state.ny.us/eab/eistate.html).
• Issuing official procedures and guidance on implementing environmental stewardship goals (http://www.dot.state.ny.us/eab/eieab3.pdf).
• Issuing an official Environmental policy adopting environmental stewardship goals (http://www.dot.state.ny.us/eab/files/policyen.pdf)

**Implementation and Monitoring**

Implementing a new program involves developing plans, revising procedures and guidelines, and monitoring progress. Steps that NYSDOT has taken (and continues to take) to implement and monitor the environmental stewardship effort are:

• Developed and updated Environmental Stewardship Action Plans for each unit in the agency.
• Reported progress on the Environmental Stewardship Action Plans monthly.
• Developed and conducted environmental training for various Department and regulatory agency staff.
• Revised procedures and guidelines to incorporate environmental stewardship goals and objectives.
• Developed reports, promotional publications, displays, and brochures relating to the Department’s environmental stewardship goals and objectives.
• Routinely consider environmental elements in NYSDOT’s activities.

**Partnerships**

The success of the Department’s environmental stewardship efforts relies on building a strong team with partners that share the vision. Internal partners include managers and staff from all the program areas. External partners include federal and state agencies, local municipalities, community groups, environmental organizations, and the public. NYSDOT has built strong partnerships by:

• Meeting with Department staff from various functional units to discuss crosscutting issues.
• Forming multi-disciplinary project teams that investigate and consider innovative environmental elements.
• Meeting with state and federal agencies to discuss and progress environmental stewardship goals and objectives.
• Discussing NYSDOT’s environmental stewardship philosophy at public information meetings.
• Modifying projects to incorporate environmental elements on the basis of continuous public feedback.
• Partnering with agencies, advocacy groups, and municipalities on projects.

**Results**

The key measure of success is getting positive results. NYSDOT has demonstrated its results by:

• Including lists of Environmental Initiative projects in the annual Capital Program Update.
• Developing and updating an environmental accomplishments book.
• Formally recognizing NYSDOT teams or individuals for outstanding environmental accomplishments.
• Establishing an environmental stewardship website (http://www.dot.state.ny.us/eab/envinit.html).
• Identifying and tracking environmental accomplishments.
• Receiving recognition for environmental accomplishments by letters of commendation or awards.
• Receiving or initiating positive media coverage for environmental contributions.

**Incorporating Environmental Stewardship into Transportation Maintenance and Operations**

NYSDOT has made a concerted effort to ensure that environmental stewardship objectives are incorporated into its maintenance and operations activities. Transportation maintenance and operations activities are typically associated either with work conducted along the right-of-way (ROW) or as facility-based activities conducted at a residency or shop. These operations activities must comply with various and complex federal and state environmental regulations and avoid or minimize environmental impacts. With the implementation of the NYSDOT Environmental Initiative in April 1998, the Department has gone beyond strict regulatory compliance to proactively protect, improve and enhance the environment as opportunities arise, especially when this can be done for little or no additional cost.
Environmental Handbook for Transportation Operations
NYSDOT has developed an Environmental Handbook for Transportation Operations to provide general awareness and guidance of the primary environmental responsibilities associated with the types of activities conducted by NYSDOT Operations staff. The Environmental Handbook for Transportation Operations describes the environmental requirements in the context of the operation or type of facility or equipment most affected by the issue. This guidance serves as a summary of typical issues and as a flag for certain issues that may require more assistance from the NYSDOT Landscape/Environmental staff or other appropriate resource personnel. The Environmental Handbook for Transportation Operations can be found on the NYSDOT website at http://www.dot.state.ny.us/eab/oprhbook.html.

Environmental Initiative Checklist for Maintenance and Operations
To face the challenge of routinely incorporating environmental components into maintenance and operations, NYSDOT staff developed an extensive list of maintenance improvement areas that support the Environmental Initiative. Some of the primary issues include reducing waste, reducing pesticide and chemical applications, improving water quality and improving aesthetics.

General operations activities identified include reusing and recycling various materials, including pavement, improving environmental factors of facilities (oil/water separators, sewer connections, salt storage buildings, energy conservation measures, visual screening), implementing erosion control and vegetation management (e.g., mowing guidelines, herbicide controls), improving roadside appearance (adopt-a-highway, graffiti abatement), cleaning pavement with biodegradable agents.

Snow and ice operations activities identified include training in snow and ice control treatments and equipment calibration to reduce material use, training of municipal snow and ice contractors and local DPWs regarding snow and ice control techniques, testing and using new snow and ice equipment, including on-board liquid systems and temperature sensors, testing and using new materials for prewetting or anti-icing applications, such as magnesium chloride, agricultural products (MAGIC), salt brine and calcium chloride.

Bridge-specific operations activities identified include using bioengineering techniques for stream stabilization, conducting clearing/snagging and scour protection of streams, cleaning bridges in an environmentally sound manner according to specification, restricting stream work dates to protect fisheries, installing fish passages, improving habitat and protecting riparian habitat.

In addition to conducting maintenance activities in an environmentally sensitive manner, the NYSDOT maintenance program is going the next step to improve and enhance the environment. Examples include: conducting outreach to County & Local DPW’s on all the above techniques, providing an online publication of the Environmental Handbook for Transportation Operations, building fishing access sites, constructing boat launch sites, installing historic signs, erecting interpretive kiosks, installing peregrine nest boxes on bridges, installing kestrel and bluebird boxes along the right-of-way, landscaping around residency buildings, developing and testing alternatives to herbicide use.

As a quality assurance measure, maintenance staff completes the Environmental Initiatives Checklist to track the environmental practices performed by maintenance staff in the Residencies, by the bridge crews and by special crews. The report is evaluated by the regional managers and submitted annually to the Main Office program manager. This process allows the program area to pilot new techniques and re-evaluate the effectiveness and extent of implementation of the various tasks. It also serves to identify areas that need increased awareness and implementation and to delete tasks that are no longer warranted.

Environmental Audit
Every year, state agencies are required to assess the environmental status of the activities carried out at or by each of its facilities, projects and operations. To improve this process, NYSDOT volunteered to be a pilot agency in submitting its annual audit electronically. Additionally, NYSDOT developed a data form for field staff to include information on Environmental Initiatives/Enhancements for the State Environmental Audit. This data form provides another source of information to report and track types of activities and enhancements that are being progressed to further the Department’s environmental stewardship objectives.
Environmental Staff in Operations
NYSDOT has determined that it needs to adjust its organizational structure to have more environmental expertise on the ground to sustain its efforts of proactive environmental stewardship. Environmental support with NYSDOT has traditionally been provided by the Regional Landscape / Environmental Units housed in the Design Bureaus. As environmental requirements and expectations have increased, there has been an increase in the need for maintenance and construction-phase assistance in the environmental field. The effort has grown to the level that requires a full time regional staff commitment in each of the regional construction and maintenance units. To meet that need, the Department is hiring 22 seasoned environmental managers to teach stewardship, deal with the various regulatory agencies and to make critical on-site decisions.

Results of Environmental Stewardship Program
Momentum has grown with the success of the environmental stewardship effort. The word has spread throughout the Department, the State and the Nation. Policies, procedures and guidance have been revised to incorporate the Environmental Initiative in the Department's projects and activities. More specific guidance and policy has been drafted drawing on the success of the projects. A website has been developed to post examples and to share successes with other staff and the public. The Department has been a national leader in helping to spread the philosophy to other state and federal agencies.

The Initiative has resulted in significant intangible benefits in the form of improved morale. Since it's “OK to be green,” DOT workers enjoy more of a sense of “ownership” of the environment that constitutes the rights-of-way and other property in DOT ownership. Through outreach to communities and groups, NYSDOT has gained stronger, more positive working relationships with external agencies, the public, local municipalities and other environmental groups. These improved relationships result in avoided costs by reducing delay, litigation, frustrating do-overs and wasted effort arguing contentious issues. By working together at the start, projects are accomplished in a more timely and productive manner for all concerned.

Conclusion
NYSDOT has found that there are numerous opportunities to incorporate environmentally sound practices and environmental improvements into the planning and design process as well as routine maintenance and operations activities. Considering the highly visible public role that maintenance and operations staff has as representatives of NYSDOT, it is a critical step to improving the public perception and increasing the Department’s credibility as an environmentally sensitive state agency and as a partner in progressing the state environmental program. This is an area where there can be great gains at little expense. NYSDOT's framework can be adapted to any state and strengthens best practices from any source. While specific projects may bring incremental improvements, a progressive ethical framework can be the basis for continuing progress for all DOTs.

Further Information
More information about NYSDOT's Environmental Initiative can be found on our website, www.dot.state.ny.us/eab/envinit.html.

Reference
Abstract
Over the past year, the Washington State Department of Transportation (WSDOT) has sponsored a process improvement team to improve the way the department conducts NEPA environmental review processes. A primary focus of this effort has been to reduce the likelihood that decisions made during the process will be revisited or discarded later in the process, resulting in wasted time, money and effort.
Prior to the reinvention approach, the formal NEPA environmental process was started after the project was in the design stage, and after the project’s scope and budget had been set, and legislative commitments had been made on a preferred alternative. With support from the Federal Highway Administration (FHWA), a team of federal and state agencies has proposed a revised process that would begin the formal NEPA process earlier, during the planning stage of potential future projects. The other major change is getting commitments from dedicated permitting and regulatory agencies to assist in the early planning stages required by NEPA.
By “moving NEPA back to the planning stage,” WSDOT will better meet the intent of NEPA, which is to consider environmental impacts of projects in the planning stages to allow for improved project design with decreased impacts. The new process as defined allows resource and regulatory agencies to be involved in the decision making steps of NEPA, and we have defined formal “concurrence” steps that commit each agency to approval of the steps in NEPA, or to non-concur based on our agencies regulatory authority. In cases of non-concurrence it allows major environmental issues to be addressed up-front rather than in the permit stages of the project when it is more expensive to re-design project elements.
Major changes with the new process:
• **NEPA included in Planning:** The revised process would begin the NEPA process at the planning stage, and end it at some point during design. Too often, work done during planning is ignored or redone when a project reaches the design stage.
• **Interdisciplinary Project Management Team:** The revised process has an interdisciplinary team that includes members from planning, traffic, environmental and project development functions.
• **Agency Input:** Permitting agencies have agreed to be part of the planning process, signing off at specific decision points to allow for “decisions that stick” rather than reconsidering issues at different stages of the process.
• **Decision Steps:** The following decision steps are approved by the agencies or the project planning stops until resolution can be completed. Each agency with permitting jurisdiction over the projects must agree to the following critical steps, and once approved, can not go back and request document revisions on these particular issues:
  1. Purpose and Need
  2. Screening Criteria and Data Needed for Review of Alternatives
  3. Alternatives to Review In the EIS
  4. Preferred Alternative
• **Improved NEPA Documents:** With agency and local government involvement, the major environmental concerns are identified earlier in the process, and better avoidance and minimization will result. This should assure faster permits in the end, since the agencies have been involved throughout. The Corps of Engineers, and Ecology will use the final EISs that are completed as our decision documents for permits. In the past, we often had to create our own EISs to meet our permitting requirements.
• **Better Public Input:** The public is involved through the steering committees and in scoping and public outreach efforts. In the past, the public would be heavily involved in the planning process, then when the EIS was prepared and changes were made to meet environmental requirements, it appeared to the
frustrated public that the planning process was being done twice. By combining these efforts, we are getting better public support of the process.

Three pilot projects are being tested with the new process. Many other DOT projects are also following the revised way to do NEPA, and better coordination has resulted. The agencies are committed to the success of the process, and dedicated staff has been assigned to each project. Better planning is resulting.
Abstract
The Joint Aquatic Resource Permit Application (JARPA) is a permit application form that consolidates seven permit applications for federal, state and local permits. JARPA is designed to simplify the permit process for applicants proposing construction, fill placement, public access impingement, and other development activities in or near aquatic environments and wetlands by allowing them to complete only one form to be submitted to the necessary permitting agencies.

Currently JARPA is being used by the Washington State Departments of Ecology, Fish and Wildlife, and Natural Resources, Army Corps of Engineers, the U.S. Coast Guard and by more than 90 local governments for the following permits:

- Section 404 permit of the Clean Water Act -- U. S. Army Corps of Engineers (Corps)
- Sections 9 & 10 permit of the Rivers and Harbors Act -- U.S. Coast Guard, Corps
- Hydraulic Project Approvals (HPA) -- Washington Department of Fish and Wildlife (WDFW)
- 401 Water Quality Certifications -- Washington Department of Ecology (Ecology)
- Water Quality Modifications -- Ecology
- Shoreline Management Act (SMA) permits – Local Government
- Growth Management Act (GMA) critical area ordinance requirements – Local Governments
- Flood damage reduction ordinance requirements -- Local Governments
- Aquatic Resource Use Authorization -- Washington Department of Natural Resources (DNR)

JARPA has been used in Washington since 1995. We have experienced the benefits of a joint permit form to be:

- Reduced paperwork and processing time – multiple applications combined into single form results in reduced cost, frustration, confusion and time delays for project applicants;
- Improved information received by agencies and local government staff – everyone reviews the same project description, site plans, maps, etc., with more detail at the outset;
- Reduction in time for receipt of permits – because only one form serves as the application for all of the required permits, there is a greater likelihood that the application will be sent simultaneously to the appropriate agencies. Improved information provided early in the process has reduced the need for agencies to request additional information;
- Reduced violations – JARPA’s cover sheet is designed to inform applicants on which permits they need, resulting in fewer violations;
- Reduced revisions and increased coordination between agencies – all permitting agencies will receive consistent information at the same time, encouraging early coordination on projects. This should reduce the need for permit revisions that are currently required when one permitting agency requires project design changes after another agency has approved a permit based on original design plans.
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION  
CONTAMINATED SITES AND ENDANGERED SPECIES ACT RISK REDUCTION  

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Abstract: Washington State's regulatory criteria for prioritizing contaminated site cleanups are primarily based on human health risk; risks to Endangered Species Act (ESA)-listed aquatic species are not directly considered. Under existing state regulation, sites considered low priority for cleanup may pose considerable risk to ESA threatened and/or listed fish species. The objective of this project was to create an internal assessment tool for the Washington State Department of Transportation (WSDOT) to assess and prioritize contaminated site risks to ESA listed aquatic species. A three-tiered evaluation process was developed to determine relative potential for contaminated sites to affect ESA-listed fish species. Based on results of an initial screening, a determination was made regarding potential impact to listed fish and/or their habitat. Sites posing potential risk were then ranked in order of priority for remedial action. Tier I evaluated sites for their relative distance to the documented presence of listed fish and their critical habitat; Tier II evaluated the status of hazardous material releases and the potential for contaminants to impact surface water and/or critical habitat areas; Tier III assigned a quantitative site scoring to rank sites based on risk to ESA-listed fish species. Scores range between 0 and 100 with higher values assigned for higher risk sites. A total of 103 sites were evaluated. Of these, 41 were considered to pose potential risk and were assigned quantitative scores. For the 16 sites receiving scores of 75 or above, WSDOT will seek funding to conduct early cleanups. For remaining sites, WSDOT will further assess whether there is sufficient risk to warrant cleanup activities. Because this model has proved useful, WSDOT will continue to use it to measure the agency's ESA risk as it relates to contaminated sites and to support expenditures for conducting further site characterization and cleanup work. Though there remains uncertainty regarding relative toxicity of individual contaminant levels on fish species, this model should prove useful to the regulated community as well as to regulatory agencies in reaching defensible cleanup decisions as they relate to ESA-listed fish.

Background  
In 1999, the National Marine Fisheries Service (NMFS), a part of the National Oceanic and Atmospheric Administration (NOAA), added nine west coast salmon to the federal ESA list. Also in 1999, the U.S. Fish and Wildlife Service (USFWS) listed the Bull Trout as threatened under the ESA. In Washington State, four species of Pacific salmon have been listed by NMFS as threatened or endangered under ESA, including Chinook Salmon (Oncorhynchus tshawytscha), Chum Salmon (Oncorhynchus keta), Sockeye Salmon (Oncorhynchus nerka), and Steelhead (Oncorhynchus mykiss). NMFS has also designated Coho Salmon (Oncorhynchus kisutch) as a candidate species for listing. In addition, the USFWS proposed that Coastal Cutthroat Trout (Oncorhynchus clarki clarkii) be listed as a threatened species. The USFWS also listed Bull Trout (Salvelinus confluentus) as a threatened species in Washington State.

Currently, hazardous waste sites in Washington are ranked for cleanup priority by the state Department of Ecology (Ecology). Ecology's ranking criteria emphasizes human health risk; risks to ESA-listed fish species are not fully considered. For example, if the only contaminant migration pathway identified is surface water, Ecology will assign a low priority ranking for cleanup action. Sites receiving a low priority ranking may in fact pose substantial risk to listed fish species but often would not undergo cleanup action for many years.

WSDOT currently faces difficulty in acquiring funding to remediate such sites, but retains liability associated with impairing listed fish habitat.

Risk Reduction Framework Objectives  
The primary objective of WSDOT's ESA risk reduction effort is to independently assess liabilities associated with impacts to listed fish at sites that are otherwise determined to pose low risk. This paper presents a
decision-making framework developed to prioritize and support WSDOT actions to mitigate impacts to listed fish habitats.

Summary of Risk Criteria Prioritization Methodology

The three tiered decision making process developed for this project is illustrated in Figures 1 through 3. The outcome of the decision making process is a determination of the relative potential for a contaminated site to affect listed fish species. For sites that may adversely affect listed fish, ranking criteria are applied to support decisions for further site characterization and/or remedial action.

The Tier I screening process identifies the location of WSDOT sites relative to the documented presence of listed fish and their critical habitat. Sites may be eliminated from further evaluation based on the distance of listed fish/critical habitat relative to the subject site and/or distance from the site to the nearest receiving water body.

Tier II evaluates the status of hazardous material releases from the site and the potential for contaminant migration to adversely affect surface water and other critical habitat. In Tier II, sites may be eliminated from further evaluation based on site specific information pertaining to contaminant release, containment, toxicity, contaminant quantity, and contaminant migration potential.

Sites not eliminated as a result of Tier I or Tier II screenings are assumed to have a potential to adversely affect listed fish and are submitted to a Tier III evaluation. The Tier III evaluation results in a quantitative scoring that ranks potential risk to ESA-listed fish on a relative basis.

The following sections discuss relevant risk criteria and provide prioritization methodology and procedural guidance as necessary to complete the decision making framework established under the Tier I, II, and III processes.

Fig. 1. Tier I Location / Surface Transport Screening
Fig. 2. Tier II Release and Migration Potential
TIER I - Location and Surface Water Transport Screening
The Tier I evaluation focuses on proximity to critical habitat of listed fish species. Generally, a site must be evaluated if it is: 1) within an ESA-defined evolutionarily significant unit (ESU) or its critical habitat; 2) adjacent to a downstream ESU critical habitat; 3) within a Bull Trout watershed; or 4) within a 1.5 mile distance of a Bull Trout migratory/foraging zone.

Sites meeting one or more of the above criteria are further evaluated to determine: 1) whether a receiving water body within 1.5 miles supports or is likely to support listed fish or a critical habitat and/or 2) any releases to stormwater conveyance systems within one mile of a listed fish/critical habitat which would not discharge to a publicly owned treatment works (POTW).

TIER II - Release and Migration Potential
Sites meeting the above criteria are subject to a Tier II evaluation. Tier II further evaluates the potential for contaminants to be released from the site and migrate into water bodies containing listed fish. This evaluation includes a comprehensive review of existing site specific information to: 1) identify confirmed or suspected contaminant release(s) to surface water, sediments, groundwater, and/or soils; 2) evaluate the adequacy of existing containment systems and/or prior contaminant removal actions (if applicable); 3) assess potential subsurface contamination and the occurrence of groundwater; 4) evaluate the toxicity and quantity of existing soil contamination; and 5) perform a contaminant migration potential assessment if necessary.

The Tier II evaluation generally considers the following: contaminant containment or removal; depth to groundwater and any existing infiltration controls; and relative toxicity and quantity of contamination. Depending on the outcome of this general evaluation, a site specific contaminant migration assessment may be required. The contaminant migration assessment examines distance to critical habitat, terrain, soil permeability, precipitation, depth to groundwater, subsurface hydraulic conductivity, and contaminant mobility.
These criteria are given weighted consideration with the final outcome resulting in a site scoring. Sites failing two or more of the scoring criteria are then subjected to a Tier III site hazard ranking.

TIER III – Site Hazard Ranking Model
Facilities or sites to be carried through the Tier III site hazard ranking process are considered to exhibit a potential to adversely affect listed fish or their associated habitats. The Tier III site hazard ranking model establishes a numerical site score as a basis for measuring relative risk. The model is based on Ecology's ranking method (Washington Ranking Method [WARM]), but adds specific emphasis regarding potential impacts to listed fish. The Tier III model includes the following primary site ranking criteria:

- **CONTAMINANT CHARACTERISTICS** – The assessment of hazardous substance characteristics includes: 1) ecological toxicity, 2) mobility, 3) quantity, and 4) bioaccumulation potential;
- **MIGRATION POTENTIAL** – The assessment of contaminant migration to surface water via either over land or groundwater flow includes: 1) soil permeability and precipitation, 2) flooding potential, 3) terrain slope, 4) subsurface hydraulic conductivity, 5) vertical depth to groundwater, and 6) containment;
- **TARGETS** – The target assessment for listed fish and their critical habitat includes: 1) distance to nearest ESA critical habitat, 2) classification of surface water type, and 3) identification of ESA status (e.g., species identified as candidate, threatened, or endangered); and
- **CONTAMINANT RELEASE** – The release assessment prioritizes documented contaminant release information for sites based on those affected media which reveal the highest potential to affect listed fish species or their habitats (e.g., in order of highest potential: surface water, aquatic sediments, groundwater, and soils).

Results and Conclusion

**WSDOT Site Prioritization Results**
A total of 103 contaminated or suspected contaminated sites were subjected to the screening evaluation. Of these sites, a total of 41 were considered to pose potential risk to listed fish and were subjected to the Tier III evaluation and assigned quantitative scores. For the 16 sites receiving scores of 75 or above, WSDOT will seek funding to conduct early cleanups in biennium 2003-2005. For the remaining sites receiving scores below 75, WSDOT will seek funding for the 2003-2005 biennium to conduct additional investigation to confirm whether or not these sites pose sufficient risk to warrant cleanup activities. WSDOT will continue to use this evaluation tool to help measure the agency’s ESA risk as it relates to contaminated sites and to support expenditures for conducting further site characterization and cleanup work.

**Implications for Future Research/Policies**
Though there remains uncertainty regarding relative toxicity of contaminant levels on fish species, this model should prove useful to the regulated community as well as to regulatory agencies in reaching legally defensible cleanup decisions as they relate to ESA listed fish. The decision-making framework will continue to be updated as chemical toxicity and threshold value information develops.

Biographical Sketch: Melany Vorass has eighteen years public sector experience in Washington State including stormwater planning, contaminated site investigation and cleanup, underground storage tank regulation, hazardous waste management, pollution prevention planning and spill prevention and response. She is currently manages the Washington State Department of Transportation’s Hazardous Materials Team with statewide responsibility for contaminated site investigation and cleanup, spill prevention/response training and dangerous waste management.

**References Used in Decision Making Framework Development**


WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
PROACTIVE APPROACH TO IMMINENT LISTING
UNDER THE ENDANGERED SPECIES ACT

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Abstract: Washington State has been experiencing an increase in the number of species listed under the
Endangered Species Act in recent years. Almost every single construction project completed by the Washington State
Department of Transportation (WSDOT) must complete a section 7 consultation. To facilitate the section 7 process,
WSDOT has developed a proactive approach to imminent listings under the act. The approaches include completing
Programmatic Biological Assessments, completion of site specific management plans for listed and soon to be listed
species on WSDOT right-of-ways, the establishment of specific programs to help recover species, such as our fish
passage barrier replacement program, and finally, conducting or sponsoring research on candidate species or
species of concern. This paper describes the process that was established to select the species that would benefit
most from research. Some of the ongoing and recently completed research projects are also discussed.

Introduction

The listing of species under the Endangered Species Act (ESA) can have a severe impact on transportation
project delivery. Projects that receive federal funding or require federal permits such as a 404 permit from the
US Army Corps of Engineers must undergo a section 7 consultation process. When species are newly listed
there is often a lack of information on their distribution and habitat needs. This lack of information can make
the regulatory agencies reluctant to complete their ESA consultations, for fear of adversely affecting the
species. Consequently, transportation projects are frequently faced with lengthy and costly delays while
decisions are reached. Sadly, such actions typically do not result in benefits to the listed species.

The Washington State Department of Transportation (WSDOT) faced a significant slow down in project delivery
in 1999 when several salmonid species were listed in Western Washington. The slow downs occurred due to a
number of reasons, including increased consultation requirements at the U.S. Fish and Wildlife Service
(USFWS) and National Marine Fisheries Service (NMFS) known collectively as the Services, a lack of staff at the
Services, and a lack of comfort at completing consultations due to a lack of information on the newly listed
species.

Project Objective

Since new listings are occurring with increasing regularity in Washington, WSDOT has developed some
proactive solutions to up-coming listings. These solutions include: 1) development of programmatic biological
assessments, 2) development of specific highway management plans for highway segments which encounter
listed species and their habitat, 3) contributing to the recovery of listed species though the establishments of
specific programs, and 4) conducting research on candidate species or species which will shortly be listed.

Programmatic Biological Assessments

We are in the process of developing programmatic biological assessments to cover many of our activities
statewide. We are developing PBA’s with USFWS for terrestrial species, bull and cutthroat trout, and NMFS for
aquatic species. The PBA’s are written to include proposed and candidate species. Upon the listing of the
species, we amend the PBA and the Services amend the Biological Opinion (BO) to allow WSDOT to conduct
consultations on large numbers of projects within the range of the newly listed species. We anticipate using
this method to complete many of our consultations on the coastal cutthroat trout when it is listed next year.
Specific Highway Management Plans
We have developed a statewide maintenance plan, which is being adopted under the 4d rule. It addresses how we do our maintenance activities in relation to listed species, especially salmonids. We have also developed a specific highway management plan for a highway segment, which runs through suitable habitat of a proposed plant, showy stickseed. This management plan was a multi-agency effort, developed in conjunction with the U.S. Forest Service (USFS) and the Washington State Department of Natural Resources (WDNR). It identifies the exact locations of the plants in the right-of-way and a process for how road maintenance and projects can be completed in the study area (Null et al. 1999).

Contribute to the Recovery of the Species
WSDOT is active in recovering species through specific programs, mainly the fish passage barrier retrofit program. This program involves inventorying the highways to locate impassable culverts, rating the potential habitat to be gained from fixing them, and prioritizing the fixes (Johnson et al. 1999). Specific projects are then funded every biennium.

Conduct Research on Species Soon to be Listed
Past research efforts were focused on specific impacts from transportation projects, such as the effect of pile driving on wintering bald eagles. Now under our new approach we have contracted and completed research projects on several listed and candidate species to fill information gaps that would have prevented successful consultations under ESA.

Unfortunately, as increasing numbers of species are placed upon the species of concern list, and many are becoming candidates, it is difficult to know which species should receive our limited research funds. There are also many charismatic species such as lynx, grizzly bears and wolves, which are currently being closely studied, providing numerous partnering opportunities. But sometimes it's the non-charismatic and little known species, which can cause the biggest problems in completing section 7 consultations with the Services. Therefore, some sort of screening tool is necessary.

Methods
We wanted a fast, easy to use method to decide which species our research efforts would provide the greatest benefit.

1. We elected to focus on species which were about to be listed, thus species which are either listed as candidates or are a species of concern with a strong possibility for listing through our regional USFWS office.
2. We then examined the species historic distribution, their current distribution, their habitat preferences, and compared this information to the location of the state highways.
3. Based on our review, species were lumped into two categories: 1) Potentially high impact species, which are those that were widely distributed historically which use habitat types that are widely distributed through the landscape, and 2) potentially low impact species, which are species that were limited in distribution and habitat types.
4. We then reviewed the literature, looking at the current knowledge base on the potentially high impact species.
5. We discussed our list of high impact species with numerous agency personnel from both federal and state agencies including USFWS, USFS, the Washington State Department of Fish and Wildlife (WDFW), and the WDNR, looking for ongoing research projects, or interest in completing research.

Based on our review, we identified two species, the Oregon spotted frog and the Mardon skipper (a butterfly), which had a high potential to impact WSDOT projects, based on their distribution and information needs. The Oregon spotted frog was once found in wetlands throughout the western lowlands and in the southern Cascade Range, but apparently it is now limited to four known populations (See Figure 1)(McAllister and Leonard 1997). The Mardon skipper is a small butterfly associated with open grasslands and ridge tops in Ponderosa pine forests in western and south-central Washington (See Figure 2)(Potter et al. 1999). We also found strong interest and potential partners in the state agencies and even private industry.

Other species that were evaluated included the basalt daisy, northern wormwood, and White Bluffs bladder-pod. These species all had a very limited distribution due to their specific habitat requirements, and thus a low
potential to impact WSDOT projects (See Figure 3)(WDNR and BLM 2000). There was also low agency interest in these species.

Fig. 1. Distribution of Oregon Spotted Frog
Fig. 2. Distribution of Mardon Skipper
Once we established our species of interest, we reviewed the literature to identify information needs. The main information gap for both species was: What constitutes suitable habitat? For the frogs, there is a lack of information on what constitutes suitable breeding habitat, and suitable overwintering habitat (Watson et al. 2000). Thus, there is no definitive method for separating suitable occupied or unoccupied habitat from unsuitable but “similar” habitat. When completing section 7 ESA consultations, all suitable habitats for a listed species is considered occupied, unless surveys using a method that has been approved by USFWS are completed to document that the habitat is unoccupied at the time. Washington is a state with a wet, temperate climate, resulting in the presence of numerous wetlands. Most highways intersect wetlands at some point, and depending on their location within the state, many projects cannot be completed without some kind of wetland impact. Without additional information on what constitutes suitable habitat for Oregon spotted frogs, the potential for ESA impacts to projects was very high. In response to this information need, we contracted with several other state agencies, and a private timber company to complete two separate studies on four separate (the remaining) populations of frogs. The studies focused on identifying wintering habitat and oviposition habitat.

We contracted with WDFW and the WDNR to complete the Mardon skipper research. This project focused on answering basic questions concerning the distribution and habitat locations of the species. In the Puget Sound area, the species is associated with glacial outwash prairies, while in the southern Cascades, it is associated with grassy savannas among the ponderosa pine woodlands. As in the case of the spotted frog, the habitats preferred by the Mardon skipper are a common habitat type associated with many state highways, especially in the South Puget Sound and the southern Cascade areas. The purpose of the research on the Mardon skipper was to be able to distinguish potentially suitable habitat and occupied habitat from unsuitable and unoccupied habitat.
Results
The spotted frog wintering study was competed in 2000. Work was completed at all four of the sites know to contain spotted frogs. Frogs were captured and outfitted with transmitters. These radio tagged frogs were located throughout the winter, and once a wintering site was located, various habitat parameters were measured so that common characteristics of the sites could be identified. Some frogs remained in place through the winter, while others moved short distances. After the completion of the wintering study, the ovipositioning study began. It focused on locating and describing the characteristics of the ovipositioning sites. Ovipositioning sites were located by surveying for egg masses, and habitat parameters were measured. Numerous single and multiple ovipositioning sites were located at each study area. Completion of these two studies provided detailed information on the habitat parameters of the wintering habitat, and ovipositioning sites.

While these studies contributed greatly to the knowledge base on spotted frogs, and they provide insight into the types of habitats that the frogs use, the information still needs to be developed into a habitat model that can be easily applied in the field by WSDOT biologists. We anticipate developing the model in 2002. We will also seek USFWS’s input to and approval of the habitat model.

There were five objectives established for the Mardon skipper study. The first objective was to conduct field surveys in the southern Cascades to establish the skipper’s range and distribution. While the Mardon skipper has been observed in the southern Cascades, its exact distribution is unknown. Surveys were designed to focus on potentially suitable habitats located near the existing highways. The second objective was to develop a descriptive habitat model to allow WSDOT biologists to identify potential habitat. Like the spotted frogs, there are miles of highways bisecting hundreds of acres of grasslands, which may or may not be suitable. The model, which focuses on vegetation communities, is designed to screen out unsuitable habitats. The third objective was to develop a survey protocol to use to survey suitable habitat. The protocol describes how potentially suitable habitat should be surveyed. The fourth objective was to create a GIS map of known Mardon skipper sites throughout the state. The fifth objective was to conduct surveys for Mardon skippers and their habitat on WSDOT lands.

All of the field work for the Mardon skipper study was completed during the summer of 2001. Field work had to be conducted within a very short timeframe as the species has a one month flight period each year, which normally occurs between May and June. It is non-migratory and survives the winter by having the pupae hibernate over the winter.

The study located several new habitat areas along highways in the southern Cascades. Survey results were mixed as the skipper had an earlier than normal flight period in the southern Cascades, and a latter than normal flight period in the Puget Sound areas. The habitat model will focus on the identification of grassland communities that contain a specific species of fescue. The survey protocol will be a multi-year survey versus a single year effort (Potter 2001). The results of this study will allow WSDOT biologists to identify suitable habitat and conduct surveys for the species. Both the descriptive habitat model and the survey protocol will be sent to USFWS for their approval.

Implications
The proactive ESA approaches that WSDOT has implemented are designed to provide their biologists and the regulatory agencies with the tools they need to successfully complete the section 7 consultations under ESA. We have found that contributing to the research efforts on listed, or soon to be listed species, can lead to multi-benefits for the species, their habitats and WSDOT. We expect to continue this approach with listed and other soon to be listed species.

Biographical Sketch: Marion Carey is the team lead of the Wildlife and ESA group in the Biology Program in the Environmental Affairs office of the Washington State Department of Transportation. The group is involved in the preparation and review of biological assessments; creation and negotiation of programmatic biological assessments with USFWS and NMFS; creation and implementation of training courses on ESA, preparation of biological assessments, and wildlife issues; evaluating methods to reduce deer and elk vehicle encounters, and contracting out research projects which involve a broad range of issues from deer detectors to in water bank protection, endangered species, and habitat conductivity.
References


ENVIRONMENTAL STREAMLINING OF THE NEPA PROCESS

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Abstract: In this paper, we offer an option for streamlining the National Environmental Policy Act (NEPA) of 1969 process for roadway projects. Section 1309 of the Transportation Equity Act for the 21st Century addresses concerns relating to delays in implementing roadway projects and directs federal agencies to streamline the environmental review process. Our objective for each of these projects was to produce a NEPA environmental document and an engineering design in a timely and cost effective manner.

The Georgia Department of Transportation and the City of Roswell, Fulton County, have contracted five of Kisinger Campo & Associates’ projects to include both the environmental document and the preliminary engineering/final design under one contract per project. These projects in Georgia include: two state routes (S.R. 53, Hall County and S.R. 140/Holcomb Bridge Road, Fulton County), two city streets (Whittlesey Road, Muscogee County and Old Alabama Road, Fulton County), and one Interstate highway interchange upgrade (I-75/Pate Road, Monroe County). Each of these projects is funded with state and federal monies.

The streamlined process of performing environmental studies and preliminary engineering at the same time at one transportation engineering firm has been beneficial for the clients in terms of time and cost savings through constant communication and coordination. For each of these projects, the right-of-way plans phase was not started until the Federal Highway Administration approved each NEPA document. With engineers, NEPA specialists, and environmental studies analysts under one roof, ongoing communication for these projects resulted in the early detection, avoidance, and minimization of impacts to historic properties, wetlands, longitudinal encroachments of streams, cemeteries, public parks, floodplains, and Section 4(f) properties. In these projects, after environmental specialists located a potential natural or cultural resource in the field, the engineers were immediately notified of them for further coordination and communication. This immediate field understanding of a project’s resources saved the engineers time because the plans were changed to accommodate the resources early in the project development. The time savings translated into cost savings, resulting in minimal delays, current plans reflecting the resources, a positive morale for the project team, and appreciation for the NEPA process. In addition, resource agencies and the transportation agencies were notified early about resources along project corridors and attended meetings to discuss alternatives, which facilitated their involvement.

The streamlining process begins with trust and commitment from the transportation agency. Concurrent environmental and preliminary engineering project development also requires good communication among the environmental analysts, NEPA specialists, and design team. The streamlining of the NEPA process results in a successful transportation project that can efficiently utilize resources to meet the public’s needs in a timely manner.

Background

In this paper, we relate our experiences in streamlining the National Environmental Policy Act (NEPA) of 1969 process for roadway projects. Based on the mandate under TEA-21, federal transportation agencies and consultants have worked to develop methods that expedite the NEPA environmental process. Section 1309 of the Transportation Equity Act for the 21st Century (TEA-21) addresses concerns relating to delays in implementing roadway projects and directs federal agencies to streamline the environmental review process. Section 1309 of TEA-21 states that “the Secretary shall develop and implement a coordinated environmental review process for highway construction and mass transit projects” which requires the preparation of an Environmental Impact Statement or Environmental Assessment. Section 1309 also states that all environmental reviews made by Federal agencies shall be “conducted concurrently” and in “a cooperatively determined time period.” The intent of Section 1309 of TEA-21 is to accomplish environmental streamlining.

Streamlining can occur throughout the pre-construction process – either internally with the government agencies, externally on the consultant design end, or a combination of both. The Georgia Department of Transportation (GDOT) and City of Roswell, Fulton County (Georgia) are two entities that understand this mandate. These entities have worked with Kisinger Campo & Associates Corp. (KCA) to streamline both the environmental and preliminary engineering design processes, which has resulted in a solution that produces financial and time-saving benefits. This method of streamlining consists of contracting one firm to perform the engineering design and the NEPA process for the same project. KCA was one of the first firms to receive this
type of contract from GDOT. The streamlining process begins with trust and commitment between the transportation agency and the engineering consultant. Due to KCA's staff of professional engineers and environmental personnel, and trusted leadership, this firm has proven both the internal capability to do the work and developed solid relationships with these entities to be responsible for designing a transportation project and producing an approved NEPA document concurrently.

**Benefits and Criteria for Success**
The process of concurrent preliminary design and environmental investigations by a consultant consists of numerous benefits and essential criteria for the accomplishment of a successful project. Among the many benefits of this streamlined approach are the early identification of avoidance alternatives, centralized external and internal communications, time and cost savings, positive morale, and improved public involvement.

**Early Notification and Time Savings**
The streamlined process provides an opportunity to develop avoidance alternatives early in the process. With engineers, NEPA specialists, and environmental studies specialists under one roof, ongoing communication for these projects has resulted in the early detection, avoidance, and minimization of impacts to historic properties, wetlands, longitudinal encroachments of streams, cemeteries, public parks, floodplains, and Section 4(f) properties. In these projects, after environmental specialists located a potential natural or cultural resource in the field, the engineers were immediately notified of them for further coordination and communication. This immediate field understanding of a project's resources saved the engineers time because the avoidance alternatives were developed early in the preliminary engineering phase and not later when changing final right-of-way plans and final construction plans is more time consuming and costly to change. The concurrent preliminary engineering and environmental streamlined process enables both specialties to obtain information and address potential issues in a timely manner.

In addition, local governments, and resource and transportation agencies are notified early about resources and preliminary design options along the project corridors and hold meetings to discuss alternatives. Once the agencies are aware of issues early in the project and thus can resolve the issues early, delays in both the final engineering and the environmental processes are avoided. The time savings translates into cost savings, which results in minimal delays, and final construction plans reflecting the resources.

**Centralized External/Internal Communications**
Centralized communications involves utilizing one project manager at the consulting firm to guide the engineering and environmental process, which facilitates communication with the transportation agency and other resource agencies, if necessary. The transportation agency does not have to interact with various consultants and different project managers for engineering and environmental deliverables. The centralized communication enables the transportation agency project manager to dedicate time to other projects without having to juggle as a moderator between more than one environmental and engineering consultant.

Centralized internal communication within the consulting firm includes: expediting questions/answers, decisions, and graphics; complete access to current roadway alignments and up-to-date preliminary design plans; and the coordinated development of avoidance/minimization measures between the engineers and the environmental professionals. The centralized communication at the consultant firm results in improved speed, accuracy, efficiency, and reduced stress. Due to the improved communications where engineers and environmental professional coworkers are just across the hall from one another, quick questions can be answered or discussed at length. When coworkers are involved with the same project, discussions about pitfalls that are encountered early in the process result in problem solving before substantial portions of either the preliminary design or environmental work has been completed. The environmental professionals have immediate access to preliminary plans on the server, and often do not even need to consult the engineers about every change in roadway alignment. This prevents work stoppages due to waiting for responses.

**Positive Morale**
Because the engineers and environmental professionals work together to solve issues, the project is not disjointed, but rather continues in an efficient manner. The engineers in the office have an enhanced appreciation for the NEPA process and the coordinated effort required to minimize impacts to natural and cultural resources, while the environmental professionals learn about constraints in road design. With
Improved engineering knowledge, environmental professionals can answer questions for the engineers in the field to assist in design efforts and to streamline the number of field trips for the project. The information exchange between the environmental and engineering professionals enables the individuals to relate well to each other, to understand the work, and to develop good relationships, which contributes to the team building and positive morale that is apparent to the transportation agency. The positive morale for the project team stems from knowing they have met deadlines together. The team atmosphere engenders confidence in the client.

Improved Public Involvement
When the same firm is responsible for the engineering and environmental processes, the engineers and the environmental professionals are keenly aware of the transportation project and many of these individuals are capable of interacting with ease at the public meetings. This can be useful as support for the transportation agency, especially when there are numerous people that request information about a project at a public meeting.

Criteria for Success
Despite the various benefits that can result from a project with concurrent engineering and environmental processes, for the consultant to complete a successful project a few criteria are necessary. The first element of success is the engineering consultant’s commitment to objectivity. In the past, this has been a criticism of contracting the environmental and engineering work to the same firm. Given that the engineers and environmental professionals are both committed to their respective fields and are guided by separate standards, there is no conflict of interest in this type of streamlined project. In our experience, the environmental specialists are concerned with preserving as much of the natural and cultural environment and the engineers know they must design a road. The balance between the environmental specialists’ desire for minimal impact and the engineers’ desire to move forward with the projects provides for internal objectivity. In KCA’s experience, when the environmental professionals bring natural and cultural resources to the attention of the engineers, the engineers work toward accommodating the avoidance of these resources, within the limits of AASHTO design standards, i.e. tightness of curves, extent of cut and fill limits, lane widths and lengths, etc. Concerning these projects in Georgia, design exceptions are possible, but in our experience, these exceptions have not been necessary. By virtue of the specialists’ commitment to their respective professions and the fact that for each of these projects the right-of-way plans phase was not started until each NEPA document was approved by FHWA, conflict of interest has not occurred and would not be expected to occur.

The second criterion for the success of an engineering and environmental project is good communication among the environmental analysts, NEPA specialists, and the engineering design team. Although communication has been identified as a benefit that results in time and cost savings, it is also a potential problem in these streamlined projects. As the project proceeds, communication must be explicit about the schedule of completing certain portions of the environmental and engineering work so that coordinating efforts can occur. In KCA’s experience, the leadership of a dedicated, open and available project manager, regular internal meetings, open door policies, and the environmental professional’s ability to use Microstation have been essential elements of communication that have contributed to the success of these streamlined projects. When a transportation agency has prior experience with the consulting firm, the decision makers would know before signing a contract that the consulting team possesses solid internal communication and can be trusted with the project.

Case Studies
The GDOT and the City of Roswell, Fulton County, have contracted five of KCA’s projects to include both the environmental document and the preliminary engineering/final design under one contract per project. These projects in Georgia include: two state routes (S.R. 53, Hall County and S.R. 140/Holcomb Bridge Road, Fulton County), two city streets (Whittlesey Road, Muscogee County and Old Alabama Road, Fulton County), and one Interstate highway interchange upgrade (I-75/Pate Road, Monroe County). The FHWA and GDOT are funding each of these projects. The objective for each project was to produce an approved NEPA environmental document and a final engineering design in a timely and cost-effective manner.
S.R. 53 NEPA Document and Design of Widening/Reconstruction, Hall County, GA
This project consists of the widening of existing S.R. 53 from 2 lanes to 4- and 6-lane sections with a 20-foot raised and depressed median with curb and gutter and sidewalks on each side of the roadway for a distance of 4.2 miles. Presently, the engineering design is in the final construction plans phase. The Environmental Assessment and Finding of No Significant Impact were signed by FHWA shortly before the preliminary engineering phase was completed.

The streamlined process resulted in the early detection and avoidance of four eligible historic register resources, two cemeteries, and a longitudinal encroachment of a headwater stream. The public involvement on this project was extensive due to 59 displacements. The environmental specialists attended the public information meeting and the public hearing not only to answer NEPA questions but also to assist in the explanation of the preliminary engineering design, especially as questions pertained to avoidance of resources. Due to the number of displacements, the public was highly interested in understanding why the alignment would shift to the east and west, avoiding certain homes and impacting others. All engineering and environmental personnel involved with this project were assets at the public involvement meetings because 286 people attended these meetings.

The streamlined process saved money and time because many changes occurred in alignments throughout the preliminary engineering phase of project development. As changes would occur to the preliminary design, the environmental specialists were notified immediately and made applicable changes to the NEPA documentation. The environmental studies specialists resurveyed the project corridor in a timely manner as needed based on the changes. Both GDOT and KCA benefited by the concurrent preliminary design and environmental process.

I-75/Pate Road Interchange, Monroe County, GA
This project would provide for upgrading the existing half-diamond interchange at Pate Road and I-75 to a full diamond as well as improving Pate Road between U.S. 41/S.R. 19 and Old Pope’s Ferry Road including associated frontage roads. The concurrent preliminary engineering and design was a critical element of this project. This project was stopped early in the process due to public opinion. However, the ability of KCA to produce preliminary engineering plans and know the exact impacts of the natural and cultural resources contributed to GDOT’s ability to assess all the details of the project and determine how to proceed with the public. For example, a number of streams and wetlands and a historic resource were identified early and field checked against preliminary engineering plans to determine the potential impacts. The engineers changed the preliminary design to avoid longitudinal encroachments and minimize wetland impacts. The streamlined process saved GDOT money and time by finding resources early and taking the preliminary engineering plans to the public early. This resulted in early coordination with local elected officials and the public to stop the project before extensive time and money went into the final design and environmental documentation.

Whittlesey Road, Columbus, GA
This project consists of the NEPA document (Environmental Assessment) and engineering design for the widening and reconstruction of Whittlesey Road from Whitesville Road to Veterans Parkway for a distance of 1.3 miles. The proposed concept for the project features a 4-lane raised median typical section with curb and gutter and sidewalks. Environmental analysis and preliminary engineering resulted in the avoidance of two eligible historic register resources. As these resources were detected, the proposed alternative alignments in the conceptual layout phase were evaluated early for cultural resource impacts and Section 4(f) issues. The early detection of the historic resources has resulted in ongoing dialog with the local government and mitigation has been proposed early in the project. In addition, the engineers determined that eliminating a proposed turn lane, due to low traffic counts, could reduce the impact of a perpendicular crossing of Roaring Branch Creek and its floodplain.

Sidewalks on Holcomb Bridge Road and Old Alabama Road City of Roswell, GA
These two congestion mitigation air quality projects consist of the design of sidewalk improvements on Holcomb Bridge Road from Big Creek to Old Alabama Road and on Old Alabama Road from Market Place Boulevard to the Chattahoochee River. New pedestrian bridges will be placed along each side of Holcomb Bridge Road over Big Creek. The project consists of concept plans, preliminary and final construction plans, completion of the NEPA documents (Categorical Exclusions), and public involvement. The streamlined
engineering and environmental process has resulted in the early coordination with resource agencies regarding the possible options for the pedestrian bridges over Big Creek. KCA expects the permitting to proceed in a timely manner due to this early coordination. Also, the streamlined process resulted in the avoidance of a publicly owned public park, a Section 4(f) resource. The Categorical Exclusions for each project have been approved by FHWA and final construction plans are in the process of being completed.

Conclusion
One appeal of the streamlined engineering and environmental process is the efficiency of using resources, such as people and money. The process of performing the environmental and engineering work concurrently can be likened to value engineering or the design build process, where multiple disciplines working on the same project results in the cost savings of catching issues early. In KCA’s experience, the concurrent engineering design and environmental process has enabled the firm to understand the full scope of each project, which can assist in providing the transportation agency with valuable information required for making decisions. The streamlining of the NEPA and engineering design processes results in a successful transportation project that can efficiently utilize resources to meet the public’s needs in a timely manner.

Biographical Sketches:

Lori G. Kennedy has over 17 years of experience in planning, environmental, design, construction inspection and funding oversight for Federal-aid transportation projects. While at FHWA, she coordinated regularly with federal, state, and local review, and resource agencies in the review/approval of design and environmental projects. While in the GA Division office of FHWA she oversaw and approved the majority of Interchange and Interstate reconstruction work in the Atlanta metropolitan area including design approval and construction oversight well into the hundreds of millions of dollars. Lori’s past experience and involvement with individual projects, from the environmental documentation stage, through the preliminary and final engineering design phases, as well as construction, demonstrates her comprehensive knowledge of the requirements for completing a project. Lori has been the chair of the TRB Subcommittee on Environmental Justice for the past six years. For the past six years she has been the project manager for AASHTO’s annual contract to write the Community Impacts/Environmental Justice/Public Involvement ETAP (Environmental Technical Assistance Program) Alerts and to serve as a technical point of contact for AASHTO on environmental justice. Lori is contracted to continue with this AASHTO project as project manager through 2004. Lori published a paper, Environmental Justice and Where It Should Be Addressed in the 21st Century Concerning the Transportation Industry Historical Perspective and Summary, through TRB and has presented it at TRB and AASHTO conferences. She has moderated at least one conference session on environmental justice annually for the past six years at TRB’s Annual meetings. Lori has also given numerous presentations across the country on environmental justice in the transportation community.

Laura Dawood has over eight years of experience in the environmental field. Laura received her MS in Conservation Biology and Sustainable Development in 2001 from the University of Georgia and has a BS from McGill University. Laura is experienced in ecological fieldwork and environmental documentation. Laura has done NEPA documentation for the following GDOT projects: GRIP EDS-441(47)(48)(49)(46)(41) and BRF-023-1(12) [two Environmental Assessments]; Whittlesey Road, STP-8060(2), Muscogee County Environmental Assessment; EDS-441(40), Putnam County Environmental Assessment; I-75/Pate Road NH-75-2(210), Monroe County Environmental Assessment; CM-00S(4) and CM-00BK(4), Old Alabama Road and Holcomb Bridge Road, City of Roswell, Fulton County Categorical Exclusions; STP-00MS(7), NH-STP-75(203), Gordon County, Gordon County Environmental Assessment; BRZLB-285(21), Troup County Categorical Exclusion; and BRZLB-2889(1), Elbert County Categorical Exclusion. Laura has also worked with the NPDES requirements for storm water, having developed comprehensive monitoring programs for GDOT projects. Laura has been involved with numerous ecology assessments, which have included wetlands delineation, Eastern Indigo Snake Surveys, stream assessments, threatened/endangered species habitat assessments, land use/cover, determining stream/wetland mitigation credits, migratory bird habitat, GPS/GIS mapping, and invasive species assessments. Laura is involved with permitting under Section 404 of the Clean Water Act.