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STEWART AIRPORT ECOSYSTEM – TAKING OFF WITH INNOVATIVE APPROACHES

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Abstract: The Stewart Airport Access Improvement Project (SAAIP) embraces the essence of New York State Department of Transportation's (NYSDOT) environmental ethic. The objectives of the project are to provide safe, efficient and improved access to Stewart International Airport, while stimulating the local economy and minimizing environmental impacts. In the end, in addition to meeting the project needs, the project results in the establishment of the nearly 7,000-acre (2,833-hectare) Stewart State Forest; preservation of the 8-acre (3.2 hectare) Colden Mansion ruins; creation of 13 acres (5.3 hectares) of wetland; preservation of a large population of a rare plant and establishment of a seed bank for its propagation; incorporation of wildlife crossings into the highway design to maintain habitat connectivity; conservation of federally-endangered Indiana bat potential maternity roosts and suitable summer roosting habitat; and creation and long-term monitoring of twelve vernal pools as breeding habitat for herptiles. This stewardship approach evolved over ten years, through partnerships, collaboration, innovation, as well as NYSDOT's willingness and support to improve the environmental conditions.

Project Setting

Stewart International Airport is located in the towns of New Windsor and Newburgh, Orange County, New York. The airport is located near the junction of the NYS Thruway and Interstate 84, and is approximately 60 miles (97 km) north of midtown Manhattan in New York City. Metropolitan New York supports an estimated population of 18.8 million people. Orange County, in which Stewart International Airport is located, is one of New York State's fastest growing counties and is losing natural tracts of land to commercial, industrial and residential development.

Stewart Properties is located adjacent to the Stewart International Airport, providing approximately 8,000 acres (3237 hectares) of open space. These lands were acquired by the Metropolitan Transportation Authority (MTA) in 1971 for the purposes of "accommodating expanded airport operations and airport compatible development" (NYSDOT, 2000).

In 1974, the MTA entered into a temporary agreement with the New York State Department of Environmental Conservation (NYSDEC) that resulted in the formation of the Stewart Airport Cooperative Agreement for specific western portions of the properties. This cooperative agreement opened these lands to public fishing, hunting, trapping, as well as recreational uses such as hiking and biking (NYSDOT, 2000). These lands and the cooperative agreement were transferred to NYSDOT in 1982.

The Stewart Park and Reserve Coalition (SPARC) is a grass roots organization founded in 1987 "to protect the 7,000 acres (2833 hectares) west of Drury Lane adjacent to Stewart Airport in Newburgh as open space" (SPARC website). As noted on their website, "through the years SPARC has served as a watchdog over Stewart Airport development and has steadfastly lobbied to influence the planning process. SPARC does not oppose airport expansion and development; its focus is to preserve the 7,000 acres (2833 hectares) west of Drury Lane" (SPARC website). SPARC was an active stakeholder throughout the development of the Stewart Airport Access Improvement Project.

Project Description

In 1992, New York State Thruway Authority (NYSTA) was authorized and directed by the State Legislature to construct the Stewart Airport Access Improvement Project "to provide direct access to Stewart International Airport from interstate eighty-four in the vicinity of the airport." (NYSDOT, 2000). In 2000, New York State Department of Transportation (NYSDOT), in cooperation with the NYSTA, completed an Environmental Impact Statement (EIS) for the Stewart Airport Access Improvement Project.

The Stewart Airport Access Improvement Project (SAAIP) includes an interstate interchange; widening, improvements and realignments to an existing local road (Drury Lane); and a new airport access road. The objectives of the project are to: provide infrastructure improvements which improve access to the Stewart International Airport (SIA), taking into consideration the SIA Master Plan Update; provide a safe and efficient highway system, including minimization of the effect of interstate traffic to and from the SIA on local roadways; stimulate the local economy consistent with local comprehensive plans; minimize environmental impacts (NYSDOT, 2000). Project elements include interchange construction, 4 new bridges, 3.1 miles (5 km) of roadway reconstruction, 1.9 miles (3.1 km) of new roadway construction, and 6.5 acres (26.3 hectares) of wetlands impact.

Exemplary Ecosystem

This project goes beyond merely meeting the transportation objectives. Many innovative measures were incorporated into the project to protect the local ecosystem from proposed and future impacts and go well beyond typical regulatory requirements.

The 7,000-acre (2833-hectare) Stewart Properties and its associated watchdog organization, SPARC, combined with NYSDOT's creative and innovative project team at the height of NYSDOT's Environmental Initiative presented an unprecedented environmental stewardship opportunity. The end result is an exemplary ecosystem, as recognized by the Federal Highway Administration (FHWA).

The components of the exemplary ecosystem include establishing a 7,000-acre (2833-hectare) state forest, preserving Indiana bat habitat, creating 13 acres (5.3 hectares) of wetland habitat, preserving a rare plant population and establishing a seed bank, creating 12 vernal pools, installing 7 wildlife crossings, reclaiming a shale quarry, and preserving an 8-acre (3.2-hectare) historic property.

The SPARC organization has been supportive of NYSDOT's efforts, writing in their Spring 2007 newsletter, "Overall, there seems to be a good faith effort to be as sensitive and protective of the surrounding wet woodland environment as possible. How very gratifying" (SPARC News, 2007). This epitomizes the goals of NYSDOT's Environmental Initiative to "promote an environmental ethic throughout the Department, advance state and federal environmental policies and objectives, and strengthen relationships with environmental agencies and the public" (NYSDOT, 1999).

State Forest Establishment

An integral component of the project is the establishment of the Stewart State Forest. Approximately 5,300 acres (2145 hectares) of the Stewart Properties was transferred to NYSDEC by NYSDOT in 1999 to establish the Stewart State Forest. The transportation department, recognizing the ecological value of the Stewart Properties, believed that the environmental resource agency was best suited to own and manage the lands as a natural resource, thus relinquishing future development opportunities for the benefit of the natural system. In 2006, NYSDOT transferred an additional 1,600 acres (648 hectares) of fields, wetlands and forests to the NYSDEC to ensure the protection of valuable habitat for several terrestrial species, including the federally endangered Indiana bat (*Myotis sodalis*).

As noted in the Stewart State Forest Unit Management Plan, "The land supports diverse wildlife, including increasingly rare grassland and shrub land bird species, amphibians and reptiles. The old roads and fields provide superior access for hiking, biking, horseback riding and carriage driving, bird watching, snowmobiling, cross-country skiing and snowshoeing, and casual recreation" (NYSDEC, 2006).

By establishing the 7,000-acre (2833-hectare) Stewart State Forest, the future functions and values of the large tract of forested and open lands are retained in an area experiencing heavy development pressure. This tract of natural land provides valuable habitat of many terrestrial and wetland species. The state forest is managed by NYSDEC for plant and wildlife habitat preservation, farming, passive recreation and hunting.

Indiana Bat Habitat Preservation

The Indiana bat (*Myotis sodalis*) is a federally-listed endangered species found within the central portion of the eastern United States, from Vermont to Wisconsin, Missouri and Arkansas and south and east to northwestern Florida. The Indiana bat is one of nine bat species found in New York.

Ongoing research by NYSDEC and USFWS in New York has provided a better understanding of the summer foraging and roosting habits of the Indiana bat. Consequently, in 2005, during consultation with NYSDEC and USFWS for a wetland permit modification, concerns regarding possible affects of the project on Indiana bat were raised.

According to NYSDEC, in New York, knowledge of the Indiana bat distribution is limited to known wintering locations - caves and mines in which they hibernate. There are eight hibernacula currently known in Albany, Essex, Warren, Jefferson, Onondaga and Ulster Counties. It is certain that the summer range of this species extends well beyond these counties since the animals disperse to breeding areas and other habitats to feed and raise their young (NYSDEC Fact Sheet).

The Indiana bat was one of the mammals included on the original federal list of Endangered Species. In New York, approximately 13,000 Indiana bats are known to exist in 8 of the 120 sites searched to date (NYSDEC Fact Sheet). While the USFWS has learned a great deal about the wintering population on Indiana bat with standardized biennial counts organized by the NYSDEC Endangered Species Unit, USFWS is continuing to study Indiana bat migratory patterns and summer habitat use within the State (USFWS, 2006).

The Stewart Airport Access Improvement Project area is located approximately 25 miles (40 km) from the closest documented Indiana bat hibernaculum. Based on information provided by NYSDEC, the closest documented maternity roosting areas to the project are located approximately three miles (five kilometers) from the project corridor (Louis Berger Group, 2005).

After the initial transfer of 5,300 acres (2145 hectares) of Stewart Properties to NYSDEC for the establishment of Stewart State Forest, NYSDOT had retained 2,100 acres (850 hectares) of land to support airport related economic development. In 2006, in response to concerns regarding Indiana bat habitat, NYSDOT, working with the NYS Office of the Attorney General, transferred an additional 1,600 acres (648 hectares) of fields, wetlands and forests to the

NYSDEC to supplement the state forest, thus ensuring the protection of valuable habitat for several terrestrial species, including the federally endangered Indiana bat (*Myotis sodalis*).

This additional land transfer satisfies the USFWS and NYSDEC concerns regarding potential direct, indirect, and secondary impacts of the project and ensures that potential maternity roost trees and summer roosting habitat for the Indiana bat will be sustained. The NYSDOT will retain 600 acres (243 hectares) for future airport-related development and transportation use in close proximity to the new interstate and interchange.

The addition of the 1,600 acres (648 hectares) to the Stewart State Forest integrates environmental concerns into the overall transportation planning process, increases the amount of land available for pedestrian and bicycle recreational use, and demonstrates a commitment to integrating environmental considerations into the NYSDOT's project development process.

Wetland Protection and Establishment

Avoidance and Minimization

The SAAIP incorporates significant context sensitive measures to avoid and minimize wetland impacts. The alignment of the new road avoids an expansive great blue heron rookery and incorporates measures to avoid and reduce wetland impacts.

The utilization of standard design practices created an impact of over 14 acres (5.7 hectares) of wetland and open water impacts. Employing wetland and terrain context sensitive design measures, the Department was able to reduce the wetlands and open water impacts to 6.5 acres (26.3 hectares). Measures included a change in the standard diamond interchange design to a partial diamond and partial loop ramp, steepening of the roadway slopes, and incorporation of retaining walls to minimize the filling of wetlands.

NYSDOT redesigned the Interstate 84 (I-84) eastbound exit ramp and the I-84 eastbound entrance ramp for Drury Lane as loop ramp configurations to be constructed in the southeast quadrant of the proposed interchange. This eliminated the I84 eastbound exit ramp in the southwest quadrant of the interchange and avoided impacts to approximately 1.3 acres (0.53 hectares) of wetlands within the quadrant.

Along Drury Lane, NYSDOT redesigned the profile and lowered the roadway in several areas to minimize impacts to the wetland system, steepened the embankment slopes to 1-on-1.5 and modified the toeofill treatments. Additionally, the width of the Drury Lane median was reduced to a minimally acceptable width of four feet in all areas of wetland impact. These changes resulted in a reduction of approximately 1.52 acres (0.62 hectares) of impacts to wetlands.

NYSDOT shifted portions of the alignment of the new airport access roadway north to further avoid and minimize impacts to wetlands along its route and to keep the alignment of the road as close to the existing Crestview Lake causeway as possible, thereby further reducing impacts to open water. Retaining walls and 1-on-1.5 slopes are being utilized to reduce impacts to wetlands even more. The combination of these modifications results in a reduction of approximately 4.52 acres (1.83 hectares) of wetland impact.

The portion of the new airport access road which impacts a large wetland will be constructed using retaining walls to minimize the footprint of the roadway. NYSDOT had evaluated the feasibility of bridging these areas, however, the significant additional cost (additional \$10.331 million for a reduction of 1.26 acres (0.5 hectares)) made this option not practicable. The final project design was able to reduce the wetland and open water impacts by more than half (14 acres to 6.5 acres (5.7 hectares to 26.3 hectares)), demonstrating design with natural concepts.

Wetland Creation/Restoration

To compensate for the unavoidable wetland impacts, the project team identified suitable sites for compensatory mitigation within the same watershed as the project impacts. Compensatory mitigation included the construction of 11.03 acres (4.46 hectares) of wetlands, 2.0 acres (0.8 hectares) of open water, and 1.37 acres (0.55 hectares) of vernal pools, resulting in an overall mitigation ratio of 3:1.

The wetland mitigation site restores 13 acres (5.3 hectares) of a drained pasture and cropland within the Stewart State Forest. This location provides greater long-term protection to the constructed wetlands and diversity to the overall environment of the state forest. By restoring the wetland within existing state lands, the site requires no additional private land purchase and will be protected in perpetuity under NYSDEC management.

Rare Plant Protection and Propagation

Subsequent to the final wetland mitigation site design, a rare plant, purple milkweed (*Asclepias purpurascens*), was identified in the wetland mitigation area. Though not regulated as a rare plant by state or federal resource agencies, purple milkweed is considered rare in the northeast. The Stewart State Forest population represents the area's largest known concentration.

Recognizing the importance of this population, NYSDOT revised the design plans to avoid the majority of the plants. To sustain the plant population, the NYSDOT worked in partnership with the NYSDEC to locate and collect seeds from

individual plants that would be lost. On July 21, 2006, representatives of the NYSDOT, NYSDEC, and other volunteers were onsite to transplant the purple milkweed generated from the seed bank into the wetland mitigation area. NYSDEC is currently using this NYSDOT-generated seed bank to grow purple milkweed for transplanting into other portions of the Stewart State Forest.

Vernal Pool Creation

To restore the vernal pool system critical for the breeding success of several species of salamanders, NYSDOT consulted with the resources experts to design and create twelve vernal pools throughout the intact forest system. These vernal pools were strategically located within the protected buffer area of state-regulated wetland systems to ensure continued protection of the resource. Each site is located within a secondary growth, mixed oak/sugar maple hardwood forest community (Samanns and Zacharias, 2003).

NYSDOT designed and created vernal pools throughout the intact forest system to facilitate breeding success of several species of salamanders, including Jefferson salamander (*Ambystoma jeffersonianum*), spotted salamander (*Ambystoma maculatum*), and wood frog (*Rana sylvatica*). The twelve vernal pools range in size from 0.04 to 0.33 acres (0.01 to 0.13 hectares), with a combined total area of 1.37 acres (0.55 hectares).

In an effort to encourage colonization and establishment of biotic communities within vernal pools, several essential habitat components were developed and incorporated into the vernal pool design plan. These features are intended to provide amphibians with breeding and developmental microhabitat crucial to successful mitigation efforts (Samanns and Zacharias, 2003).

The design of 12 vernal pool sites incorporates innovative construction techniques to enhance functional value, including the placement of brush piles for cover; tree snags for cover and structure for egg laying; restricting construction operations to avoid disruption to resident populations; and incorporation of leaf litter and organic substrates from impacted wetlands to inoculate the pools with organic matter, micro-flora and fauna as the basis of the vernal pool food chain.

Wildlife Passage/Habitat Connectivity

To sustain the natural connectivity of the habitat north of the new airport access road (on the airport runway side of the road) to the vast forest south of the access road, NYSDOT planned and designed wildlife crossing structures under the road. Two oversized conspan structures are included in the road design to allow large mammals, such as white tailed deer, to cross between the forested tracts. Additionally, box culverts have been installed to maintain hydraulic connection between the systems and to provide passage of amphibians, reptiles, and small mammals. The wildlife underpasses and amphibian crossings maintain habitat connectivity for amphibians and larger mammals and are intended to minimize wildlife-vehicle collisions.

Amphibian Box Culverts

Three box culverts measuring 4 ft x 4 ft (1200mm x 1200mm) will be installed to connect the wetland systems in the western portion of the new airport access road and to provide safe passageways for breeding amphibians. Amphibian barriers will be installed adjacent to each culvert opening to divert migrating amphibians into the culverts rather than across the roadway (Louis Berger Group, 2002). The culverts will be installed partially below ground surface and filled with native soil material to meet existing ground elevation to provide a substrate suitable for amphibian use. The position of the culverts at the low point in the landscape and opening to an existing wetland should improve the potential for salamander use of the culvert by increasing the soil moisture within the culvert (Samanns and Zacharias, 2003).

Amphibian barriers will be installed in conjunction with each culvert opening to divert migrating amphibians into the culverts rather than across the roadway. The amphibian barriers will extend an average of 164 feet (50 meters) to tie into elevated upland forest sites. The barriers are designed to provide a minimum height of 14 inches (450mm), and the terminal ends of the barrier will be turned back toward the culvert at 45-degree angles. The barrier will be constructed of reinforced concrete to both reduce the need for maintenance and to provide structural support to the roadway embankment (Samanns and Zacharias, 2003).

Wildlife Conspects/Culverts

Two wide conspects 12 ft x 7 ft (3600mm x 2100mm) will be located within the large easternmost wetland system along the new airport access road. Two reinforced concrete pipe (RCP) culverts (3 foot) (900mm) will also be located within the same wetland system, one slightly to the east of the conspects and one slightly to the west. While amphibians may use these culverts in addition to the box culverts, the general culverts are intended to provide passage to a wider assortment of wildlife that may include mammals, reptiles, invertebrates, and fish where permanent water flows (Louis Berger Group, 2002).

The structures will be three sided to provide a natural substrate. The conspects and culverts are located within the western portion of the new airport access road where it crosses through a valley containing a large emergent and forested wetland. In this section, the roadway footprint has been minimized to reduce wetland impacts through the use of retaining walls. The roadway will be approximately 20 feet (6 meters) high above the adjoining ground, forming an

effective barrier for wildlife movement. The wildlife passages are expected to provide adequate sites for wildlife movement. The two spans provide an openness ratio of 0.85, indicating that these structures will be suitable for use by deer, the largest mammal likely to use these crossings (Samanns and Zacharias, 2003).

Site Reclamation

One of the goals of the NYSDEC is to reclaim areas within the forest that are not consistent with a forest ecosystem. One such area is an old shale quarry located within the boundary of the Stewart State Forest.

In order to restore the forest ecosystem, the NYSDOT used soil excavated from the wetland mitigation areas (as well as additional off-site soil sources) to bring the former quarry to a more natural grade. The area was seeded with a native seed mix in an effort to integrate the reclaimed land with the surrounding ecosystem and habitat. The natural surrounding topography was used to determine the proposed grading, allowing nature to dictate the proposed grading of the reclaimed land. The final limits, proposed grading, and seed mix were determined through a collaborative effort between NYSDOT and NYSDEC.

After NYSDOT finished the construction portion of the reclamation, NYSDEC began developing a plan to monitor and manage the area. The reclamation of the abandoned shale quarries promotes the restoration and preservation of the Stewart State Forest's ecosystem integrity and function.

Historic Preservation

The historic significance of the Stewart Properties is sustained in the preservation and proposed restoration of an eight-acre (3.24-hectare) Colden mansion property as a Scenic and Historic Resource of the State. NYSDOT collaborated with the state Office of Parks, Recreation and Historic Preservation (OPRHP) and the Town of Montgomery to preserve and restore the ruins of a 1767-era mansion associated with the Colden family, one of the preeminent families in New York State history. Constructed of local stone, the Colden Mansion was thought of as the "finest Georgian Home" in the area.

In addition to the mansion, the property contains other sites of historic importance, including ruins of a cook house (summer kitchen), a cistern, barns, wells, and a cemetery. NYSDOT will transfer the property to the town. The OPRHP will work with the town to list the site in the National Register of Historic Places and secure funding for future stabilization and interpretation activities.

The property is commercially-zoned and was previously subdivided for development, but was never sold or developed. The NYSDOT is in the process of transferring ownership of the property to the Town of Montgomery who will proceed with the preservation and stabilization of this significant historic resource. This acquisition and transfer embodies NYSDOT's sensitivity to historic, cultural and community values, and displays innovative opportunities with planning and project development by utilizing the State's ability to acquire a sensitive property for its preservation. The town will ultimately operate the property as a park enhancing the understanding of the unique heritage of the site as well as supporting tourism.

Collaboration

The environmental stewardship approach of the project resulted from collaboration with resource agency staff to develop innovative approaches, provide environmental benefits, and offset the environmental impacts resulting from this airport access improvement project. Consistent with the Department's Environmental Initiative efforts, NYSDOT initiated discussions with state biologists from NYSDEC to discuss proactive enhancements such as incorporating wildlife crossings into the project design. During these discussions, NYSDOT biologists and landscape architects offered that vernal pool creation and wildlife brush piles to create suitable habitat for herptiles and small mammals would be positive enhancements in line with the Department's environmental ethic. Discussions with state and federal biologists also resulted in collaborative approaches to protect and sustain suitable endangered Indiana bat habitat and rare purple milkweed populations.

Likewise, the transfer of over 7,000 acres (2833 hectares) of forested and open lands to the state resource agency showed initiative and partnering at its best. Recognizing the value and contribution of these open lands to the surrounding landscape, NYSDOT worked with NYSDEC to transfer these lands to the resource agency that is charged with managing state lands for its natural resources value. This collaboration has resulted in thousands of acres of land available to the people of the state of New York to enjoy and appreciate.

Ecosystem Benefits

The people and the area surrounding Stewart Airport have benefited from innovative and proactive efforts on behalf of NYSDOT. The tangible benefits include valuable habitat preservation and creation and historic property preservation. It is important to acknowledge that these achievements stem from the willingness and creativity of talented engineers working closely with Department environmental and landscape architecture staff and resource/regulatory agency biologists. Though environmental professionals may envision innovative solutions, it is the project engineers that are able to make these ideas come to fruition in the design and construction of the project. This multi-disciplinary team approach is essential to the success of a project.

Ecosystem benefits are not free and not everything can be done. Each decision needs to consider the associated cost and the value of the resource. When the multi-disciplinary team of engineers, environmental staff, landscape architects, and program managers work well together, the project team can make well-informed, fiscally wise, balanced, and environmentally sensitive decisions, resulting in exemplary ecosystems.

Future Research Opportunities

NYSDOT has made a commitment to follow through on each element of the ecosystem initiative for this project. In addition to the standard 5-year monitoring period for the wetland mitigation site, NYSDOT has committed to a 10-year monitoring program for the vernal pool sites and wildlife passages.

To address issues relating to herptile crossings, NYSDOT initiated a four year research project. In the spring of 2005, the State University of New York College of Environmental Science and Forestry (SUNY-ESF) was awarded a contract entitled "Effects of New York State Roadways on Amphibians and Reptiles: Research and Adaptive Mitigation Program." This research project is funded through the Federal Highway Administration (FHWA) Statewide Planning and Research (SPR) program. The study duration is scheduled for four years; NYSDOT's share of the project cost is \$189,000 (Nelson, et al., 2005). NYSDOT is also looking to collaborate with a local university to conduct research into the function and amphibian colonization of the created vernal pools.

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