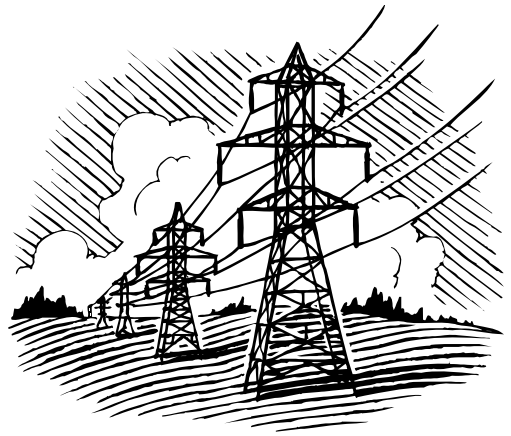




**PSEG**



**CONSTRUCTION AND RESTORATION STANDARDS  
FOR THE SUSQUEHANNA-ROSELAND  
500 kV TRANSMISSION PROJECT**

April 20, 2010

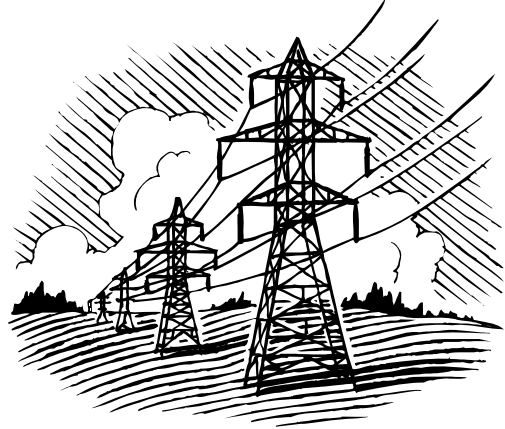
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## INTRODUCTION

The Susquehanna-Roseland (SR) Project is a major construction project that extends across some of the most diverse and sensitive environmental resources in Northern New Jersey, including approximately 26 miles through the New Jersey Highlands Region. This requires environmentally responsible design standards that prescribe the methods to be used for construction within and in proximity to sensitive environmental resources and for the appropriate restoration of the same.



Several of New Jersey's land use regulatory programs implement their authority and assure compliance through a permit review and approval process. However, in addition to securing required permit approvals, there is also a growing trend for companies to go beyond compliance and to take proactive steps to self-police themselves in order to reduce potential incidents of non-compliance and enforcement actions.

These additional efforts are often voluntary and can be established through the creation of appropriate design standards that can bring about positive environmental outcomes. However, these Construction and Restoration Standards (CR Standards) are not the equivalent of self-imposed permit conditions that fall neatly under the auspices of a single regulatory authority. Yet, many of the standards are rooted within the larger regulatory framework where the protocols for non-compliance with existing regulations are properly found and can be enforced accordingly. As Potoski and Prakash (2004)<sup>\*</sup> indicate "Underlying these trends is a profound urge among firms and regulators to move from tight-fisted, deterrence-based regulatory approaches to a more flexible and voluntary approach in which firms self-police and adopt environmentally progressive policies."

This document has been prepared to detail the construction related activities and establishes the environmental standards that will be used for the general construction and restoration of the Project. This document is designed to be a contractor compliance document. However, it has also taken on a regulatory context by reference within the approval issued by NJ Highlands Council and the NJDEP permits applications for the Project. In this regards, it will continue to advise as well to internally and externally establish the appropriate environmentally responsible behavior of our contractors and their subcontractors. Also it is possible that the ongoing coordination between the NJ Highlands Council, NJDEP and PSE&G may further refine or amend the various standards contained herein, especially as on-site field conditions continue to be evaluated during and after construction. As a New Jersey Company, PSE&G recognizes the sensitive nature of the Highlands Region and that the successful completion of the Project in a timely and responsible manner is dependent upon the actions we take during construction and immediately thereafter to be good stewards of the region. These standards will help to promote this goal.

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<sup>\*</sup> The Regulation Dilemma: Cooperation and Conflict in Environmental Governance, by Matthew Potoski and Aseem Prakash. Public Administration Review, March/April 2004, Vol. 64, No. 2



## **GUIDING PRINCIPLES AND BEST MANAGEMENT PRACTICES**

These CR Standards will be merged with the overall Comprehensive Mitigation Plan (CMP) components which are being prepared under the direction of the Highlands Council by the Company within the Highlands region. These include plans for threatened and endangered species, soil erosion and sediment control, avian management, vegetation management, wetlands and transition area mitigation, stream and riparian management, forest management as well as historic resources and Green Acres properties. These integrated mitigation strategies will work together to provide best management practices to help guide the Project during the construction phases, reflected in the CR Standards and to perpetuate ecological stewardship of the ROW, especially within the Highlands Region as reflected in the CMP components. Such strategies include general mitigation and management options that can be applied broadly across the ROW and also specific enhancement and mitigation mechanisms that can be implemented within more sensitive environmental areas. The CR Standards have been developed and will be implemented in coordination with the Highlands Council, the NJDEP, the USFWS, the Soil Conservation Districts and other agencies as appropriate.

### **Professional in-field Oversight of construction activity shall be required**

There will be a full-time environmental compliance (EC) firm as well as construction management inspectors hired by the Company on site to assure compliance with construction contract requirements including public safety measures and environmental compliance standards. In addition, the EC firm will also employ qualified field biologists and herpetologists who will be regularly stationed on the job to provide the proper oversight for compliance with the permit conditions and general environmental management, especially with respect to wetlands, threatened and endangered species and sensitive stream resources.

### **Protection of Rare, Threatened or Endangered Species**

The CR Standards prescribes the necessary construction and restoration standards that shall be used to protect rare, threatened and endangered species. The CMP Critical Habitat Plan will identify the enhancement and mitigation opportunities for improving habitat and supporting the long-term integration and management of these species with the ROW management following construction.

### **Adherence to Wetlands and Flood Hazard Regulations**

The proposed Project and all mitigation measures will be developed in accordance with all applicable State and Federal laws, including existing protections for wetlands, waters, transition areas, riparian buffers, endangered and threatened wildlife, etc. All construction and environmental work will be conducted under the applicable permits including Freshwater Wetlands Permits, Flood Hazard Area Permits, Scientific Collecting Permits, and others, as necessary.

### **Soil Erosion and Sediment Control**

Certain elements such as soil erosion and sediment control plans are based on well-established standards developed over decades via the oversight of multiple regulatory agencies and typically administered by the Soil Conservation District. Correct implementation of these measures is shown to reduce or prevent adverse affects due to erosion or sedimentation that might otherwise occur in areas adjacent to construction.

### Contractor Training

Contractors shall be provided training by the Company on the applicable policies and procedures to be followed in accordance with the CR Standards and related State and Federal law. All contractor staff working within critical habitats shall be required to participate in this training, prior to entering the construction workspace. In addition, a protocol shall be established to direct contractors as to the appropriate course of action to be taken if individual rare species are encountered within the workspace during the course of their activities. Work within certain sensitive areas will be overseen by qualified environmental professionals in the field.

### Wetland and Stream Mitigation/Restoration

These standards include elements detailing protections and restoration techniques that will be applied to impacted wetlands and waters. As these areas are often also designated as critical habitats, protections contained within these standards will necessarily be a benefit to all rare plants and wildlife that may utilize such resources. Techniques to be employed include guidelines for vegetation restoration, habitat management, riparian restoration, stream crossing protocols, and vernal pool protection.

### Forest and Vegetation Mitigation/Restoration

As with the wetland and stream elements, these standards also contain provisions for the management of forests and vegetation along the ROW and the temporary access roads. As these areas are often also designated as critical habitats, protections contained within these standards will necessarily be a benefit to all rare plants and wildlife that may utilize such resources.

### Adherence to Ecological Timing Restrictions

As coordinated with the Division of Land Use Regulation, NJ Division of Fish, Game and Wildlife, USFWS and the PJM phased electrical outage periods, construction activities will adhere to timing restrictions to the extent practical as enacted by the regulatory agencies or recommended by the partners stakeholders or PSE&G's consulting biologists to prevent certain disturbances during a particularly sensitive season for a given species (such as den emergence for rattlesnake or breeding season for vernal pool species). Often, timing restrictions for threatened wildlife and trout species overlap each other and generally correspond to the active season from spring into fall, however, specific restrictions or more limited time periods within and outside of these times may apply, in accordance with NJDEP and USFWS permit conditions or as a result of consultation with these agencies and others.

### Adherence to Construction and Restoration Standards

The following pages contain the general Construction and Restoration Standards that shall be used for the construction and immediate restoration of the Project:

## **IMPLEMENTATION OF THE CONSTRUCTION AND RESTORATION STANDARDS**

The implementation of these standards shall be used in the field during the SR construction and restoration efforts by the following key groups including:

- 1) General contractors and their approved subcontractors hired by the Company to construct the various aspects of the Project.

- 2) PSE&G personnel who are responsible for assuring permit compliance and an environmentally responsible Project.
- 3) Environmental compliance firms and their environmental compliance officers, inspectors, biologists, herpetologists and other specialists hired by PSE&G to monitor and assure compliance with these environmental performance standards.
- 4) Environmental restoration firms hired by the Company to implement specific restoration techniques of the CR Standards that are specialized and beyond the scope of the general contractor and who will also establish the enhancement mitigation areas.

## **ENVIRONMENTAL RESPONSIBILITY POLICIES FOR CONTRACTORS**

- 1) All contractors and their approved subcontractors shall have a demonstrated understanding and high regard for the environmental resources of the region and the resources identified on the construction site plans. They shall have read and shall understand all the approved permits for the Project and the CR Standards for the Project.
  - a. The primary documents to be used for construction access are the Individual Freshwater Wetlands Permit Plans and the Flood Hazard Permit Plans and the Keller & Kirkpatrick Proposed Access Roads Plans and Profiles and any amendments thereto. No deviations from these construction plans shall be allowed without written approval from the Company.
- 2) All principal general contractors and principal subcontractors, as well as compliance firm and restoration firm principals shall be required to attend a training session presented by PSE&G prior to the start of construction that would detail the environmental resource issue of the region, the CR Standards and the responsibilities of PSE&G and their agents and contractors for delivering an environmentally responsible Project.
- 3) Construction operations shall be conducted to prevent any unnecessary scarring or defacing of the natural vegetation and surroundings in the vicinity of the work.
- 4) Construction methods shall be designed to limit, so far as reasonable, erosion or subsidence. The contractor shall abide by soil and resource conservation and protection measures in accordance with the specifications and that the PSE&G Engineer determines necessary, and specified in the CR Standards and NJDEP and SCD Standards as a minimum.
- 5) Contractor shall follow ecologically sound construction practices as identified in the Permit requirements and as outlined in the certified Soil Erosion and Sedimentation Control Plans and notes and as required by State and Federal Regulations and the CR Standards, to ensure both public acceptance and minimal environmental degradation.
- 6) Contractor shall adequately control equipment maintenance operations to prevent contamination (alien plant/wildlife species or seeds/pathogens/toxic substances, etc.) of the right-of-way and adjacent areas and any water resources, including wetlands,

watercourses and bodies of water on or adjacent to the right-of-way, and prevent accumulation of debris of all types and containers of liquid waste products.

- 7) All petroleum products and other hazardous materials shall be properly containerized and labeled. No drainage onto the ground or into streams shall be allowed. A totally enclosed cage or other wildlife-proof and wind-proof containment shall be provided for all trash. All garbage, debris, and foreign matter shall be removed to an established sanitary landfill or other recognized disposal facility at Contractor's expense.
- 8) The contractor shall comply with all applicable federal, state, and local laws and regulations concerning the use, storage, transportation and disposal of hazardous materials. These substances include but are not limited to petroleum products, fertilizers, wood preservatives and solvents.
- 9) The contractor shall plan its work around the Time Restrictions as required by the NJDEP, the CR Standards and attached documents.
- 10) The contractor shall confine its operations to the immediate construction area and shall use care in placing construction tools, equipment, excavated materials, and construction materials and supplies, so as to cause the least possible damage to the property.
- 11) The contractor shall restrict operations to access road, structure work space and lay-down areas. At the conclusion of the work all temporary structures and other facilities incidental to the new construction shall be removed and the Site shall be restored to its original condition, unless otherwise directed by the Company.
- 12) All access routes, storage yards, right-of-way and properties associated with the project shall be kept free of foreign material, debris and litter. All job sites shall be left clean to the satisfaction of the property owner at the completion of each major phase of the construction.

## **ENVIRONMENTAL COMPLIANCE**

- 1) There will be a full-time EC firm as well as construction inspectors hired by the Company on site to assure compliance with construction requirements including public safety measures and environmental compliance standards.
- 2) In addition, the Company will also use qualified field biologists and herpetologists who would be stationed on the job to provide the proper oversight for compliance with the permit conditions and general environmental management, especially with respect to wetlands, threatened and endangered species and sensitive stream resources. A construction monitor approved by the NJ Endangered and Nongame Species Program (ENSP) will be on site to locate, capture and move timber rattlesnakes (and northern copperheads) per the ENSP protocol.

- 3) If items or areas of possible archaeological interest are encountered while performing work, activities at that Site shall be halted and a company representative shall be notified immediately. Archaeologists will be called in to analyze the find. Work may either be continued or the design modified as directed by the Company Representative. Contractor shall include the proper protection and or restoration to be as required.

## **TRAFFIC CONTROL AND OPERATIONS**

- 1) The Contractor will work with government agencies regarding traffic control and public safety when related to movement of construction equipment, material delivery, foundation installation, structure erection and cable installation.
- 2) Flagging and traffic signs will be used to notify drivers of short-term traffic slowing or stoppage because of utility work.
- 3) To the extent practicable, the proposed Project access roads shall be located on existing gravel or paved roads. The Contractor will avoid disturbance outside of the access road rights-of-way.
- 4) New temporary access roads have been designed to the minimum standards as shown on the construction details that will enable equipment to safely reach a structure location.
- 5) Construction vehicles, both gasoline and diesel-powered, that are to be operated upon public highways of the State of New Jersey shall comply with the regulations as required by N.J.A.C. 7:27-14 and 15.
- 6) Vehicles transporting fill, soil or other materials to and/or from the construction areas will be covered with canvas or similar material.
- 7) Mufflers and intake silencers will be utilized on all construction equipment, in accordance with federal and state requirements, as applicable.
- 8) Silencers, shields or enclosures will be placed around all stationary, noise-generating equipment;
- 9) Operation of machinery will be limited to work time frames as allowed by local laws.
- 10) No fuel storage or refueling from fixed or mobile sources is permitted within 300 feet of a wetland or watercourse, or 150 feet of a riparian zone or floodplain.
- 11) All fuel storage shall have 110% containment of largest container, double wall. Refer to Permits in a spill situation.
- 12) Care shall be taken to avoid oil spills or other pollution while working in or near bodies of water.



- 13) Refueling of construction equipment shall only be conducted over portable spill containers and will only be permitted for immobile equipment.
- 14) Washing of construction vehicles and equipment will not occur within work zones or staging areas.
- 15) Absorbent spill response materials shall be readily available on-site in reasonable proximity to work sites along with personnel qualified to use them. The Company and NJDEP and local and County Environmental agencies shall be immediately notified of any hazardous material spills at any location of the Project or other water quality incidents in watershed or aquifer protection zones. Spill prevention and response
  - a. Train staff responsible for handling fuels and other hazardous materials,
  - b. Inspect and maintain construction equipment in proper working order,
  - c. Establish designated areas for vehicle fueling, material storage, and overnight parking of equipment
    - i. Fuel all equipment at least 300 feet from the nearest waterbody or wetland, or 150 feet of a riparian zone or floodplain,
    - ii. To the extent practicable park equipment overnight at least 300 feet from the nearest waterbody or wetland, or 150 feet of a riparian zone or floodplain, and
    - iii. Store hazardous materials, lubricating oils or fuels more than 300 feet of a wetland or waterbody, or 150 feet of a riparian zone or floodplain.
  - d. Maintain spill containment and clean up supplies
    - i. At locations where hazardous materials, lubricating oils or fuels are stored.
    - ii. where fueling activities take place, and
    - iii. Within active construction areas.
  - e. Provide temporary secondary containment for fueling areas.

## **TEMPORARY ACCESS ROADS**

- 1) All access roads shall be temporary. The access roads are identified in the Individual Freshwater Wetlands Permit Application Plans dated December 12, 2008, and last revised February 1, 2010 and any subsequent revisions thereto as required by the NJDEP. These roads have also been profiled on Keller & Kirkpatrick Access Roads Plans & Profiles, dated October 2009, for Sections 1, 2 and 3.
- 2) Vehicular traffic shall be limited to the established access roads and established work areas around structures. Any damages to crops or ground cover caused by Contractor's activities off of the access roads or structure work areas shall be the responsibility of Contractor. In accordance with the Individual Freshwater Wetlands Permit Application Plans there are two different classifications of access roads:
  - a. Heavy Duty – A new access road that will be installed and maintained by Contractor, but removed once the project is completed. The width of this road is

16 feet (not including the sloped banks on each side) and shall be free of vegetation to a height of (15) feet from the road surface.

- b. Light Duty – A new access road that will be installed and maintained by Contractor, but removed once the project is completed. The width of this road is 10 feet and shall be free of vegetation to a height of (10) feet (not including the sloped banks on each side) from the road surface. Light Duty access roads shall not be used by any vehicle with a width or height that cannot be accommodated by these distances, or by any vehicle greater than two (2) tons GVW.
- 3) When constructing the access road or right-of-way from existing roads, no Contractor shall alter the existing drainage courses or drainage patterns.
- 4) Stream beds, flowing or dry, shall not be used for construction roads or vehicle movement, for any class vehicle.
- 5) When roads are to be located adjacent to streams or wetlands, as shown on the approved NJDEP plans, silt fence and a buffer or filter strip of sufficient width is to be left in place to prevent the silting of the stream until the area is sufficiently stabilized. The silt fence and a buffer or filter strip shall be installed using advanced stability techniques (e.g., trenching and backfill of the silt fence, larger and deeper stakes) and routinely inspected, with any evidence of silt bypass immediately corrected.
- 6) During construction activities, dust control shall be as required to minimize dust as required by the Company. As required, controls shall be implemented to combat wind erosion and dusting problems on areas traveled by construction equipment.
- 7) When rutting occurs, Contractor shall fill and repair all ruts as soon as conditions warrant. On areas where standing water collects due to construction related rutting, Contractor shall make provisions drain the water using appropriate sedimentation and erosion controls.
- 8) Felled trees in work areas shall be the responsibility of Contractor to be removed from site as approved by the Company, unless specifically designated as being reserved for later restoration efforts. To the maximum extent possible, felled trees shall remain on site (safely dismantled so all slash is flush to the ground) in areas where they can provide wildlife habitat/cover or will simply decompose naturally to recycle nutrients. Trees identified to be removed offsite shall be inspected to ensure that they do not harbor invasive insect species listed for the region by the U.S. Forest Service or NJDEP Forest Service, such as the emerald ash borer or the Asian long horned beetle.
- 9) The Standards for Soil Erosion and Sediment Control in New Jersey refer to the latest edition and revisions of the same generated by the State Soil Conservation Commission, New Jersey Department of Agriculture.
- 10) The work for access road ends at the center line of the proposed structures.

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- 11) Contractor is to lay-out any work prior to begin construction and the same shall be approved by the Company prior to the beginning of construction. Layout shall be the centerline of a road or structure.
- 12) All of the above access roads are required to be removed and restored by the General Contractor, unless specific provisions are incorporated with the Environmental Restoration contractor to restore these areas when part of an environmental enhancement or mitigation project which shall be in accordance with the specifications.

## VEGETATION CLEARING

1. Clearing of vegetation is to be kept to a minimum, therefore limits to clearing will be strictly enforced.
2. Clearing in wetlands and watercourses: Mechanized equipment shall not be operated directly within wetlands. All vegetation shall be removed by hand from wetlands and watercourses unless otherwise directed by the Company. No clearing debris shall be left in wetlands or watercourses or within their transition areas (e.g. wetland buffers) unless specifically designed as part of the mitigation process.
3. Crossing of wetlands or watercourses not identified on the drawings is prohibited. An orange construction fence must be installed and maintained for the duration of construction activities at all wetland locations, in order to impede any traffic crossing into wetlands.
4. Desirable vegetation (compared to invasive or exotic vegetation) shall be preserved to the fullest extent possible. This shall be coordinated with the Company. The Company shall provide a photographic catalog of invasive and exotic species to the contractor for reference in the field.
5. Contractor is responsible for the removal of all wood debris which cannot remain on site. To the maximum extent possible, felled trees shall remain on site (safely dismantled so all slash is flush to the ground) in areas where they can provide wildlife habitat/cover or will simply decompose naturally to recycle nutrients. Debris targeted for removal shall be removed from the site while the Contractor is working in the area. Burying or burning of wood or wood waste is prohibited.
6. Contractor shall grade ruts and stump holes associated with clearing work prior to leaving the site to the full satisfaction of the Company.
7. Contractor shall stabilize all disturbed soil likely to erode prior to leaving the site to the full satisfaction of the Company.
8. Stabilization of disturbed soils in wetlands that are likely to erode shall be done with an approved wetland seed mix.
9. All vegetation shall only be cleared to less than or up to the limits of disturbance shown on the NJDEP site plans and Contract Drawings.
10. The contractor shall mark all trees and shrubs to be removed on access roads at least 2 weeks prior to working in that area to allow the Company's Representative time to inspect the work. This activity shall be provided in the 2-week look ahead.
11. All trees that are to be removed shall be inventoried prior to removal and the Contractor shall maintain a log of each tree removed by caliper and species for future restoration purposes.

All removals shall receive prior approval by the Owner's Field Representative or the Company.

12. Contractor shall keep closed at all times any gates within the ROW or along access roads.
13. Contractor and environmental compliance firms shall coordinate and take appropriate precautions onsite during construction to avoid the transport of seed sources of invasive plant species to other locations of the project ROW. In order to avoid the introduction of non-native or invasive exotic plant species within sensitive plant ecosystems, such as natural heritage priority sites like Lake Denmark, the contractor shall be responsible for the establishment of equipment wash-down areas, if required in the location and design specified by the company. Once established for a particular area, the wash-down of equipment and machinery shall be required upon entering and exiting the jobsite.
  - a) Wash down areas shall be designated on stable surfaces but not on public roadways and surrounded by silt fence and hay bales and appropriately signed to advise contractors and inspectors of these precautions.
  - b) Equipment washdown should occur on an impervious pad such as reinforced concrete, with a perimeter curb and preferably within a prefabricated or mobile facility. Stormwater access to the pad should be minimized. If unroofed, the pad should be kept to the smallest practical surface area to contain washdown residues. The washdown pad should grade to a collector gully.
  - c) Water collected from the washdown pad should initially drain from the collector gully via a pipe or culvert to a sediment trap, to settle and allow removal of soil and other heavy contaminants. The trap should provide a minimum water detention capacity of one hour under peak flow conditions, for effective gravity settling of solids.
  - d) High pressure water, steam cleaning, scrubbing or quick-break detergents should be the first choices for cleaning mechanical equipment. The quantity of settled soil material and sludge in any sediment trap should be monitored and periodically removed for appropriate disposal at a registered landfill.
  - e) Shop drawings will be required.

## **SOIL EROSION AND SEDIMENT CONTROL**

- 1) Silt fence shall be installed and maintained along the perimeter of the access roads. Within 300 feet of a wetland or watercourse, or 150 feet of a riparian zone or floodplain, the silt fence and a buffer or filter strip shall be installed using advanced stability techniques (e.g., trenching and backfill of the silt fence, larger and deeper stakes) and routinely inspected, with any evidence of silt bypass immediately corrected.
- 2) When the road is going through the work area, the silt fence shall be installed and maintained along the perimeter of the work area.

- 3) Silt fence shall also be installed and maintained along the perimeter of adjacent wetlands to the access roads, work areas and structures; within the Right of Way.
- 4) When an access road, work area or structure ends or is next to a wetland within the Right of Way, Contractor shall place and maintain silt fence between the wetland and access road, work area or structure.
- 5) All construction activities shall be performed in accordance with the Soil Erosion and Sediment Control Plans certified by the Soil Conservation District in which the activity is located.
- 6) Water breaks shall be constructed at intervals stipulated by the Water Break distribution table on the plans entitled "Proposed Access Plans and Profiles" last revised through March 31, 2010. The table defines the required interval of the water break based upon temporary roadway grades. For examples, on temporary road grades of 10%, the distance between the water break shall be no greater than 78 feet. Water breaks will discharge to a scour hole, which has been designed to reduce discharge velocity and collect sediment.
- 7) Water breaks shall also be installed at the direction of the Soil Conservation District, the NJDEP or company representatives based upon field conditions as needed.
- 8) Soil Erosion and Sediment Control efforts shall be strictly enforced in the vicinity of steep slopes and open water bodies such as lakes and streams and wetlands.
- 9) Soil Erosion and Sediment Control shall also be strictly enforced for the protection of trout streams, special aquatic resources within the Project area within high quality streams that include macro-invertebrates and special aquatic species including the triangle floater and the dwarf wedge mussel.
- 10) Existing topography will be maintained to the greatest extent possible in the proposed Project site planning stages to minimize the amount of grading required.
- 11) Construction activities will be limited to the area of disturbance designated on the approved Site Plans.
- 12) Hay bales or silt filter fencing to prevent erosion will be installed and maintained along ALL disturbed areas, as appropriate. In areas where the NJ Landscape Project mapping values habitat for timber rattlesnake, wood turtle and bog turtle, or within 1,000 feet of a certified vernal habitat, wildlife passage must be provided no less that every 500 feet in the form of tunnels, gaps or overlaps in fencing such that soil erosion and sediment control is facilitated while not precluding wildlife movement.
- 13) All disturbed areas not scheduled for construction activities will be stabilized within 30 days by seeding, mulching, fertilizing and the utilization of plantings in accordance with the Transmission ROW Vegetation Management Plan and the Wetlands and Transition Area Mitigation Plan/Forest Management Plan.

- 14) Vehicles transporting fill, soil or other materials off-site will be covered with a heavy duty canvas tarp to prevent the contents from being scattered or spilled during vehicle movement.
- 15) Sediment filter fencing will be erected around and/or down slope of disturbed areas to prevent sediment from being transported into streams, lakes or wetland areas.
- 16) Upon completion of final grading, disturbed areas will receive a final seeding and mulching in accordance with the approved Soil Erosion and Sediment Control Plan.
- 17) All soil erosion and sediment control measures will be kept in place until construction is complete and/or the disturbed areas are stabilized.
- 18) Excavated soils will be temporarily stockpiled within the work area, removed by dump truck and disposed of off-site as appropriate. Excavated soils will not be placed in sensitive habitats such as wetlands, transition areas, and riparian zones or within floodplains.
- 19) Suspension of dust from construction activities including soil stockpiling operations will be controlled by wetting surfaces with water and the utilization of other wind erosion control methods as necessary.
- 20) No herbicides, pesticides, or other similar chemicals shall be used, unless indicated in the specifications and or approved by the Company.
- 21) Contractor shall include silt fence adjacent to access road construction, all wetland protection measures, and anti-tracking pads as indicated on the plans or as required in the specifications.
- 22) Contractor shall manage and divert runoff from up gradient areas away from disturbed areas whether inside or outside of ROW.
- 23) Contractor shall employ appropriate dewatering controls where dewatering is necessary. Such controls may include sediment traps, energy dissipation at the point of discharge, stabilization measures (e.g., rip rap, mulch, erosion control matting/blankets).

## **CONSTRUCTION WORK NEAR STREAMS, WETLANDS AND RIPARIAN ZONES**

- 1) To the maximum extent practicable, and as required by NJDEP permit approvals, any construction within a stream channel will be scheduled around the timing restrictions specified in Table E at N.J.A.C. 7:13-10.5 (d).
- 2) Vehicles will only be operated across a stream channel over a temporary bridge or other approved structure. Driving directly across a stream channel with machinery or vehicles is prohibited.
- 3) At locations where a temporary access road must be built across a stream channel, the crossing will be constructed as closely perpendicular to the stream channel as possible and will generally span the channel using a prefabricated bridge design.
  - a. Prior to the construction of proposed temporary stream crossings, the Company or their agent, shall conduct a physical assessment of the stream systems prior to construction to characterize the pool and riffle complexes.
  - b. Authorized stream crossings should be made at the pool and not within the riffle point, while being respectful of the timing restrictions for trout and other species.
  - c. All disturbed sections of stream channels will be stabilized after construction and restored to their pre-construction conditions with respect to channel slope, elevation and discharge capacity.
  - d. Natural streambed materials will be replaced; construction will be staged so that a minimal amount of soil will be exposed at any given time; soil stabilization measures will be implemented as quickly as possible after clearing to minimize erosion.
- 4) Mining of any stream channel is prohibited.
- 5) Stream channel modifications, except as included as part of a specific restoration/mitigation component, are prohibited.
- 6) Extraction of water from rivers, streams or any other natural source is prohibited.
- 7) Direct stream channel fording is prohibited.
- 8) No logs or boulders that provide fish habitat shall be removed from the channel.
- 9) Low flow aquatic passage shall be maintained both during and after construction.
- 10) Unset or raw cement shall not be allowed to come in contact with water in the channel.



- 11) Operation of equipment outside of the construction limits in wetlands and riparian zones as shown on the approved plans is prohibited.
- 12) Disposal of trees, brush or other debris within floodplains, stream corridors, wetlands and wetland transition areas is prohibited.
- 13) Upon completion of construction, all temporarily disturbed stream channel sections will be restored to their pre-construction conditions through replication of channel bottom elevations, shape, width and meandering, as well as replanting of native vegetation.
- 14) Temporarily disturbed areas will be restored to their pre-existing conditions, including replacement of vegetation removed during construction, by reseeding and replanting with indigenous plant species.
- 15) In addition, natural sediment transport patterns will be preserved by replicating the ratio of shallow areas to deep areas, anticipated flow rate and streambed material.
- 16) Materials used for temporary stabilization will be removed after construction is completed and construction equipment access is no longer necessary.
- 17) Construction equipment contact with flowing water is prohibited and shall be minimized through the use of marsh mats, temporary coffer dams or culverts to divert flow around construction activities.
- 18) Contractor shall take such measures as are necessary to ensure unrestricted passage and movement of fish and wildlife. No artificial structure or stream channel change that cause a permanent blockage to movement of fish, reptiles or amphibians shall be constructed.
- 19) Soil and woody material stockpile areas, if any, will be located away from wetlands, transition areas; riparian zones, floodplains and State open waters. These stockpile areas will be protected with hay bale filter barriers and/or silt fencing at their base.
- 20) The existing tower footings will be excavated and removed to a depth of two (2) feet below the ground surface. Footing locations will be backfilled, graded to match existing elevations and seeded. All dismantled steel and associated hardware will be removed and recycled as appropriate.
- 21) Wood chips chipped from existing trees on site trees may be spread within the ROW but shall not exceed 3" in depth on average and shall not be deeper than 6" in any one location. No chips may be left in wetlands and watercourses or their buffers.

## CONSTRUCTION WORK WITHIN WETLANDS AND RIPARIAN ZONES

- 1) Construction timing and sequence
  - a. Whenever possible, avoid construction activities requiring crossing of waters classified as Trout Production or Trout Maintenance during critical periods as follows.
    - i. Trout production – September 15 through March 15
    - ii. Trout maintenance/trout stocked – May 15 through June 15
  - b. Employ construction timing restrictions during critical periods where construction activities occurring within the designated Riparian Areas or Open Waters may affect wetlands, vernal pools and/or state or federally listed species.
- 2) The approved site plans show the locations and details for the use of marsh mats which shall be used for all construction work within wetlands to minimize the amount of disturbance to vegetation and compaction of soils within these areas.
- 3) The disturbance of existing roots and topsoil beneath marsh mats and crane pads and access roads will be avoided to the maximum extent possible.
- 4) To the maximum extent possible, existing surface water drainage patterns will be maintained through the use of temporary pipes and culverts. Wildlife passage shall be assured through the use of drift fence designs that lead to critter culverts to enable reptiles and amphibians to safely pass through the marsh mats.
- 5) The area used for access to the construction location shall be minimized to the maximum extent practicable. Track equipment and low profile vehicles designed for distributing weight must be used when the ground is soft to avoid soil compaction.
- 6) Disturbance/removal of trees for access to the construction site shall be minimized to the maximum extent practicable; unless specifically designed as part of the mitigation process. Whenever trees must be removed, selective removal of trees less than 4 inches in diameter is preferred in lieu of removal of larger trees.
- 7) Tree stumps will not be removed, encouraging the revegetation of the tree via sprouts unless these trees are within the ROW and would otherwise be required to be removed through the NJBPU regulations.
- 8) Where construction access roads require tree and shrub removal to achieve appropriate width, replanting of cut areas with native trees and shrubs will be performed once the access road is removed and the site is restored to pre-existing contours.
- 9) Excavation and filling activities will be conducted in a manner to minimize turbidity and sedimentation. Placement of embankments (filling) will be conducted in such a manner as to contain sediment at the fill areas.

- 10) The limits of disturbance have been indicated on the approved final design plans and represent the maximum area necessary for the construction of the new transmission line, although the area may be designed by the contractor to be of less disturbance.
- 11) Slopes will be protected as soon as possible with vegetative cover, or as a temporary measure with fiber mats or straw mulch. A protective area of vegetative cover will be established between embankments and wetland areas.
- 12) Erosion control measures within the riparian zone and wetlands
  - a. Minimize area of disturbance and soil exposure; preserve existing vegetation.
  - b. Install silt fence and/or hay bales at up gradient boundary of wetlands and streams.
  - c. Install silt fences in the riparian zone along stream that cross the ROW or access roads placed in a manner that reduces concentrated stream flows.
  - d. Manage and divert runoff from areas outside of ROW away from disturbed areas.
  - e. Use temporary sediment traps for larger areas of disturbance.
  - f. Establish and maintain sediment tracking controls at construction access/egress points.
  - g. Use directional tracking and tillage as needed when working on steep slopes.
  - h. Cover or otherwise provide temporary stabilization for soil stockpiles.
  - i. Employ appropriate dewatering controls.
    - i. Use sediment traps for construction dewatering, if required.
    - ii. Direct sediment trap discharge to undisturbed vegetated area avoiding steep slopes and concentrated flow to prevent erosion of downstream areas.
    - iii. Employ energy dissipating measures (e.g. riprap at sediment trap outlet).
    - iv. Promptly correct and stabilize any areas disturbed by the dewatering discharge; adjust discharge approach to avoid additional erosion.
  - j. Seed and/or mulch disturbed areas up gradient of streams and wetlands within 24 hours of disturbance to prevent soil erosion.
    - i. Mulch may be used where additional disturbance is anticipated or when seasonal conditions necessitate delay of replanting.
    - ii. Annual rye grass erosion control seed mix may be used for temporary revegetation prior to restoration replanting.
- 13) Other construction measures
  - a. Conduct pre-construction stream surveys at designated crossing locations to support later restoration efforts. Photographically document locations and identify pre-construction plant communities.
  - b. Stockpile topsoil (outside of wetlands and riparian areas) for reuse during post-construction restoration.
  - c. Stockpile selected cut trees, root wads, rocks/boulders, and brush for potential use as in-stream habitat, bank stabilization, and/or to replace coarse woody debris in restored transitional floodplain forest.
  - d. While using marsh mats for stream and wetland crossings within the designated riparian zone

- i. Install jacks as needed to raise elevation of marsh mats to exceed the anticipated stream water elevation occurring during a one year storm event.
- ii. Install temporary gravel anti-tracking pad at each end of the marsh mat to minimize tracking and discharge of soil into the stream while crossing mats.
- iii. Install filter fabric barriers along stream banks flanking marsh mats.
- e. Limit access to riparian and wetland areas where disturbance is not required for construction.
  - i. Use construction fencing or other physical barriers if possible; at a minimum use visual posting/flagging of such areas.
- f. Clearly mark Open Water and Riparian Areas where special construction practices are required.
- g. Conduct visual monitoring of streams before, during and after construction.
  - i. Complete at least two pre-construction observations (one dry and one wet weather) for each stream crossing.
    1. Note any visible turbidity.
    2. Measure turbidity using a hand-held turbidometer.
  - ii. Inspect each stream crossing in active construction or disturbed areas after each storm event.
    1. Use paired monitoring locations (one upstream of construction activities, and one downstream)
      - a. measurable storm event defined as rainfall greater than 0.1 inches or
      - b. Sufficient to produce runoff in the construction zone if greater than 0.1 inches.
    2. Note any visible turbidity.
      - a. If turbidity is visible, measure turbidity using turbidometer.
        - i. If turbidity downstream of construction activities is more than 10 NTU<sup>2</sup> above the upstream reference location, implement corrective actions to identify the source of turbidity, and minimize soil erosion.

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<sup>2</sup> Nephelometric Turbidity Unit (NTU)

## RESTORATION STANDARDS

- 1) Temporary restoration activities will be an ongoing process and will occur from the initial ground disturbance to the permanent restoration and required maintenance of the right-of-way (ROW) according to the permit requirements and the BPU regulations.
- 2) Restoration will include removing all temporary gravel and marsh mat work pads, access roads, mat roads and bridges, regrading where necessary, seeding with a native meadow seed mix and installing native tree and shrub plantings where required.
- 3) Restoration activities will be performed and their success monitored for three years as required by the NJDEP regulations developed specifically for this proposed Project.
- 4) Permanent restoration of the ROW and access roads, pulling areas and staging areas can begin as soon as the cable installation is completed.
- 5) Sequencing of construction activity shall enable the construction work that requires site access through the wetlands to be completed within six months to enable their restoration to occur as soon as possible. This will be accomplished through the removal of the proposed marsh mats and the geotextile fabric; the regrading of the disturbance to loosen soil compaction; if needed and the seeding of these areas with a wetland conservation seed mixture. These measures will be used along with appropriate erosion control measures and monitoring to assure successful reestablishment of wetlands vegetation and hydrology.
- 6) Restoration plantings for all temporary disturbances shall also include long term monitoring and required success ratios, otherwise the contractor shall be required to replant or reseed areas which do not meet success ratios at their expense.
- 7) Roads shall be removed and restored no later than six (6) months after the Transmission Lines for a particular segment have been energized.
- 8) Contractor shall coordinate all restoration work the Environmental restoration contractor specifically with respect to the wetland restoration and re-forestation work.
- 9) Contractor shall restore all areas as close as possible to its original state, match existing contours of adjacent areas and match existing landscaping. Restoration activities shall be designed to prevent the establishment of invasive species and to eliminate existing invasive plants within the disturbance area, to the fullest extent possible.
- 10) Contractor shall provide Pre & Post construction documentation such as but not limited to photographs and video, etc; clearly indicating its location. Documentation procedure is to be approved by the Company and Program Manager.

- 11) Contractor shall at all times limit the movement of crews and equipment to avoid unnecessary rutting the right-of-way, marring the land and damaging crops, pasture and hay land.
- 12) Contractor shall be responsible for any disturbance to the project area.
- 13) Contractor shall be responsible for all reseeded activities that may be needed due to disturbance.
- 14) Post-construction restoration
  - a. Restore in-stream habitat to approximate pre-construction conditions.
    - i. Remove temporary crossing structures and/or fill materials.
    - ii. Regrade stream bed to mimic pre-construction grades (as needed).
    - iii. Install boulders and large woody debris to replace physical features removed to accommodate equipment crossing.
  - b. Restore stream bank to approximate pre-construction conditions.
    - i. Remove temporary fill materials on and adjacent to banks
    - ii. Regrade bank to approximate pre-construction conditions
      1. Except where significant bank erosion was evident in pre-construction conditions.
        - a. Regrade to stable slope to correct pre-construction bank erosion.
    - iii. Implement “typical” or site-specific restoration design as designated for the location based on pre-construction surveys.
      1. Anticipate that a vast majority of locations will be addressed with a typical design.
      2. Anticipate that a small percentage (<5%) of locations may require site specific design.
  - c. Restore riparian zone to approximate pre-construction conditions.
    - i. Remove any temporary fill materials on and adjacent to banks
    - ii. Regrade disturbed areas as necessary to restore grades to approximate pre-construction conditions.
    - iii. Where significant vehicle traffic has occurred, soils may be scarified prior to replanting, as appropriate for the planting mixtures proposed.
    - iv. Replant riparian zone to achieve conditions which approximate pre-construction conditions.
      1. Seed and/or mulch disturbed areas up gradient of streams and wetlands within 24 hours of disturbance to prevent soil erosion.
        - a. Mulch may be used where additional disturbance is anticipated or when seasonal conditions necessitate delay of replanting.
        - b. Use the PSEG upland, wetland or riparian seed mixes, as appropriate for final seeding.
      2. Allow for natural recruitment and introduction of native shrub and tree species as allowed for within the Transmission Right of Way Vegetation Management Plan.

- 15) Implement invasive species control measures as needed until vegetation is well established. The Company shall provide a photographic catalog of invasive and exotic species to the constructor for reference in the field.

## **SEEDING SPECIFICATIONS**

- 1) Contractor shall submit all Certifications from suppliers that the products provided meet the purpose of the technical specifications, such as but not limited to; seed mix showing purity and germination of each seed type and total pounds of seed required per acre.
- 2) Seeding shall be performed at all areas where roads are removed, disturbed areas, and as directed by the Company. Contractor shall be responsible for seed germination.
- 3) All access roads shall be removed in their entirety to include fill areas, cuts and fill shall be reconstructed to the original ground elevation.
- 4) Furnish and install 5 inches of topsoil and seed and fertilizer as indicated on the plans. Seeding rates and mix shall be as shown on the plans. Topsoil and seed shall be installed in all areas requiring restoration to include roadways, slopes, and restored cut and fill areas.
- 5) Seed shall be fresh, clean, new crop seed consistent with grasses native to the area and shall be approved by the Company prior to application.
- 6) Seed shall meet the requirements of the New Jersey Department of Agriculture.
- 7) Seed shall be labeled according to U.S. Department of Agriculture Federal Seed Act, and furnished in containers with tags showing variety of seed in mixture, purity, germination, weed content, name of seller, and date on which seed was tested.
- 8) Seed shall be accompanied by certificate from the contractor that seed meets requirements of these technical specifications on the approved plans for the Project.

Seedbed Preparation: Where practical, dispose of any rocks or other obstructions which might interfere with tilling and seeding operations. In areas where ground surface is compacted hard enough to prevent drill penetration, thoroughly loosen and pulverize soil to a depth of at least 3 inches. Maintain tilled areas until seeded. After access roads are removed, place topsoil over disturbed areas prior to seeding. Naturally occurring rock outcrops and rock fields should not be disturbed.

- 9) Seeding specifications for the restoration areas are also shown in Appendix A consisting of select restoration seed mixtures specifically formulated for the project by Ernst Conservation Seed Company. These seed mixtures were selected as natives to the county/area and for their wildlife and aesthetic quality that they will provide.

- 10) All disturbed areas shall be seeded within the following seed mixes at the rates recommended by the supplier.
- 11) The application areas for the permanent seed mixes shall be determined in the field by the engineer and the project restoration specialist.
- 12) Temporary Seed Mix: Apply annual ryegrass at a rate of 1 LB per 1,000 SF
- 13) PERMANENT SEED MIX: Native seed mixes were specifically formulated for the Project and the region by ERNST CONSERVATION SEED COMPANY of Meadville, PA and include the following mixtures

Transmission Right of Way Seed Selections Mixes

- a. ERNST 01: Buena Vista Upland Seed Mix (Short)
- b. ERNST 02: Buena Vista Upland Seed Mix (Tall)
- c. ERNST 03 Steep Slope Scenic Mixture
- d. ERNST 04 Riparian Restoration Mixture
- e. ERNST 05 Facultative Wetlands Restoration Mixture
- f. ERNST 06 Obligate Wetlands Restoration Mixture

Woodland Temporary Access Road Restoration Seed Mixes

- a. ERNST 07 Herbaceous Upland Mix for Partial Shade
- b. ERNST 08 Herbaceous FACW Mix for Partial Shade
- c. ERNST 09 Herbaceous/Woody Upland Mix
- d. ERNST 10 Herbaceous/Woody FACW Mix Shade

- 14) Seed mixtures as supplied by Ernst Conservation Seed Company of Meadville PA 16335 shall be the first choice for the select seed mixtures above, however if for unforeseen reasons, they are unable to produce or reasonably provide the mixtures requested, then another vendor must be approved by the Company as being able to provide the seed mixtures of equal or better quality and species compositions as the original specifications prior to the application of the same in the field.
- 15) If the disturbed area is located within a wetland, the area will be seeded with one of the three native wetland seed mix shown above to stabilize the ground and prevent erosion until natural vegetation is re-established.
- 16) If the disturbed area is located within erosion hazard areas, or along steep slopes the area will be restored to pre-existing contours and stabilized by seeding with the native seed mix for steep slopes and seeding with annual ryegrass for upland/transition areas. However, the grading and contouring of the landscape may also be required to diffuse or divert concentrated flow using terraces, diversion trenches or erosion control mats or blankets until the site has reached a stable condition.



## THREATENED AND ENDANGERED SPECIES STANDARDS <sup>3</sup>

### Avian Protection

- a) Bald eagle (Structure Locations 38/4, 82/2-82/3) - Avoid all disturbance within 330 feet of the nest during the nesting season (January 1 – July 1) or in accordance direction provided by the Endangered and Non-game Species Program (ENSP). Several pairs are known to nest in the region and these nests are protected by an expansive limit of disturbance buffer. Efforts to reduce and minimize the impact to this species will need to be coordinated with the US Fish and Wildlife Service. If the construction activities are visible from a nest, the USFWS states that the buffer must be 660 feet. If the activities are not visible, then a 330 foot buffer is acceptable. The nest building/breeding/fledging season in Northern NJ is considered to extend from January until August.
- b) Old growth and contiguous wetland forests stands should not be fragmented by access roads or paths to avoid impacts to barred owl, red-shouldered hawk, and northern goshawk habitat. To the extent practicable, siting of such access roads should occur in existing edge or disturbed portions of forests. Probable den trees should be avoided by construction activity.
- c) The use of temporary access roads should avoid creating an unreasonable disturbance near existing mapped or newly established nesting sites for red-shouldered hawks, including a ¼ mile buffer, during the breeding season, which generally occurs from March 1 through May.
- d) Similarly, within Cooper’s hawk habitat, the construction and site disturbance activities shall be limited within a ¼ mile buffer around a known nest site until after the breeding season, April 1 through July 31, in mixed riparian or wetland forests.
- e) A survey for northern harrier nest sites should occur along the ROW edges and within emergent wetlands located within 1,000 feet of the ROW. 1000-foot protection buffers should be maintained around all documented nests during the breeding season (late February through late June) to the extent practicable and as coordinated with the environmental compliance firm , the company and the appropriate regulatory agencies.
- f) Initiate construction-related clearing activities in the ROW prior to the bird breeding season, which occurs from mid April – July to the extent practicable.
- g) Implement mechanical noise source attenuation to reduce noise from construction equipment;
- h) Avoid disturbance to active nest sites:

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<sup>3</sup> This section of the Standards relates to threatened and endangered species protection measures that will be utilized during construction. See also the Critical Habitat/Endangered Species Plan and the supporting documentation regarding the full extent of the flora and fauna in the vicinity of the project site.

- a. Black vulture (structure locations 41/1-41/2) - avoid disturbance within 200 feet of the nest during the nesting season (March – June);
- b. Great blue heron rookery (structure locations 63/3-64/2) - avoid disturbance within 600 feet of the rookery during the nesting season (March – May);
- a. Golden-winged warbler (structure locations 64/3 – 64/4) - avoid all disturbance within 500 feet of this span during the nesting season (May – August); breeding surveys must be conducted and reported to the DLUR's E&T Unit on spans 39/3-41/1, 64/1-64/3, and 64/4-68/6 prior to disturbance to determine if avoidance is necessary;
- b. Confirm active nesting by red-headed woodpecker and raptors:
  - i. Red-headed woodpecker (55/4) – A red-headed woodpecker was observed at tower 55/4 in mature forest habitat adjacent to the right-of-way that contained several potential nest cavities. Nesting should be confirmed prior establishing in-field construction management recommendations. Any potential nest sites (snags) in this area should not be removed.
  - ii. Other raptor nests (66/4-67/2, 72/4-73/2, and 73/6-74/2) – These spans have been known to contain raptor nests adjacent to the right-of-way in the past years but it is unknown if these nests are active. They will be confirmed in 2010 during the nesting season prior to establishing in-field construction management recommendations.
- i) All practices above will be addressed on a case by case basis prior to construction activities with the NJDEP ENSP program. Should nesting locations change, or practices be implemented to avoid impacts to certain species within time of year restrictions, PSE&G shall proceed after consultation with ENSP or the applicable regulatory agency.

## **Contractor Training**

Contractors will be provided training by PSE&G on the applicable policies and procedures to be followed in accordance with the CR Standards and related State and Federal law. All contractor staff working within critical habitats will be required to participate in this training, prior to entering the construction workspace. In addition, a protocol shall be established to direct contractors as to the appropriate course of action to be taken if individual rare species are encountered within the workspace during the course of their activities. It is also expected that work within certain sensitive areas will be overseen by qualified environmental professionals.

## **Timing Restrictions**

The construction of this project will be controlled by electrical outage periods. These enable work to be completed within the right-of-way while the transmission line is turned off, but service must resume as the summer months approach. As a result, it is necessary to balance the

safety of workers and the standard timing restriction intended for the protection and well-being of certain wildlife species.

The company shall attempt to adhere to all standard timing restrictions requested by the Department, but will have the opportunity to demonstrate that alternative protective measures that accomplishes equal or better species-protection objectives might be warranted when a timing restriction would unreasonably interfere with an established outage period. This shall be coordinated with the DEP-DLUR in response to site-specific needs.

## **Vernal Habitats**

Construction-related mitigation – In cooperation with the EC and staff herpetologists, the contractor shall insure that all vernal ponds shall be silt fenced (using “super silt fencing” or equivalent) with built in herptile passage ways to prevent sedimentation of the ponds while allowing access for breeding and dispersal. All super silt fence and barrier/wildlife tunnel treatments must be in place prior to the commencement of any proposed construction or use of any road, laydown or staging area. Silt fence installation and herptile passage shall be based on a typical diagram to be provided to the Department for its review and approval, and thereafter modified to suit the existing conditions based on in-field direction provided. Daily timing limitations would be proposed would limit activities conducted along the ROW in the vicinity of vernal ponds between sunset and sunrise as migratory activities typically occur after dark. . Seasonal timing restrictions will be considered to ensure that all appropriate or required mitigation treatments are in place prior to the typical breeding/migration period, as follows:

A. opacum pools: All site prep in place prior to September 1.

A. maculatum, A. jeffersonianum, A. laterale, L. sylvaticus, P. crucifer, C. guttata pools:

All site prep in place prior to Feb 15.

Warm-weather species (all remaining Lithobates, Hylidae, or unmentioned species): All

site prep in place prior to May 1.

Vehicles shall stay on established roads in the vicinity of vernal ponds to prevent animals which wander away from the pond and hide under rocks, logs, brush and debris during the day from being accidentally crushed. Roads created, improved or used in existing condition within 50 feet of a vernal pool should employ wetlands matting as appropriate to minimize the generation of sediments generated adjacent to the pool. New temporary access roads in the vicinity of vernal ponds would be constructed with culverts and directional funnels to prevent the roads from becoming barriers limiting access to and from the ponds. Seasonal conditions may also apply that would limit work during critical seasonal breeding periods depending on the species present and the prevailing weather patterns. However, any seasonal work limitations must also be cognizant of the designated outage periods established by PJM to assure reliable energy demands are met during critical periods such as during the summer months.

PSE&G should remove all large woody debris or other potential herpetile refugia from within the footprint of construction, staging or laydown areas, as well as from any areas where roadway improvements will be made, 2 weeks prior to any proposed use of the area. Herpetiles species should thereafter be allowed to vacate the area. Two weeks after any available refuge has been removed, the work areas should be silt-fenced as directed above, precluding re-entry into the work area. Logs over 15” in diameter and 118” in length, including rootwads with attached trunk lengths where appropriate, will be salvaged and stockpiled for use as habitat logs, wildlife snags, and log crib walls. Habitat logs will be anchored to flood terraces, installed as rootwads, and/or included in log crib walls as deadmen. They will provide potential basking habitat for the western pond turtle, and cover for amphibians. Wildlife snags will provide bird and raptor roosting habitat. Log crib walls will be utilized for grade breaks, to create micro-topographic features and to adjust grade at tree saves. Habitat logs may also function as nurse logs for new or transplanted salvaged plants.

## **Wildlife Tunnels**

In advance of disturbances within particularly sensitive critical habitats (e.g., vernal pools, amphibian travel corridors, bog turtle habitats), the use of installed drift or silt fencing and wildlife crossings on access roads (wildlife tunnels) shall be installed as determined by the EC, the GC and the Company based on site field conditions and species of concern. The purpose would be to mark the limits of allowable construction disturbance and to prevent rare species from entering construction sites where they would be subject to harm. In addition, areas shall be pre-screened to insure that target species are not present, and if found, moved beyond the limits of the exclusion fences for safety by or under the supervision of qualified personnel. Tunnels and one-way passages would allow wildlife to move under, around, or through the area safely or direct them back to undisturbed areas. Inspections of the disturbance areas for species of concern shall occur on a daily basis. Trenches, ruts and holes can trap migrating salamanders and newts, these areas should be inspected daily especially during the breeding season, preferably first thing in the morning. Any individuals found must be moved by or under the supervision of qualified personnel. Fencing will not be used within 2 miles of known rattlesnake dens (applicable access roads and ROW segments to be identified by the ENSP); alternative measures will be incorporated to prevent other reptiles and amphibians from traveling but permitting rattlesnakes (and copperheads) to move freely through the area.

## **Bog Turtles**

No conservation measures for the federally listed (threatened) bog turtle are necessary in the vicinity of those wetlands for which the USFWS has concurred in writing with a negative Phase II (visual) survey result. To avoid impacts to the bog turtle and its habitat, the following conservation measures developed in cooperation with the USFWS (tracking # 2008-I-0319) will be incorporated into the construction plans for all wetland areas that are confirmed as bog turtle habitat (through field surveys and/or Landscape Project mapping) or that are treated as such in the absence of a Phase II survey. If the following conservation measures cannot be implemented for any particular area of confirmed bog turtle habitat, PSE&G will work with the USFWS to

develop alternative site-specific conservation measures sufficient to avoid adverse effects to the bog turtle.

- a. No permanent structures (including but not limited to tower footings and new or improved access roads) will be located within 300 feet of confirmed bog turtle habitat. All confirmed bog turtle habitat, plus a 150-foot buffer, will be flagged prior to construction and will remain flagged during all work in that span. No temporary disturbances (including but not limited to removal of existing towers or other structures, use of motorized equipment, earth disturbance, and equipment/materials storage areas) will take place within flagged areas. If vegetation must be managed within flagged areas, PSE&G will follow the conservation measures detailed in its October 23, 2009 letter to the USFWS.
- b. In any span containing confirmed bog turtle habitat, a double row of silt fencing will be installed around all work areas (e.g., areas for installation of new tower footings or other structures, removal of existing towers or other structures, construction of new or improved access roads, use of motorized equipment, earth disturbance, equipment/materials storage areas, other temporary work spaces) prior to the start of any construction. As described in a., above, all work areas will be at least 150 feet from confirmed bog turtle habitat (i.e., outside of flagged areas). Work areas will be inspected by a recognized, qualified bog turtle surveyor concurrent with fence installation, to ensure no bog turtles are present. In any such span, a recognized, qualified bog turtle surveyor will inspect work areas and flagged areas daily for any work between April 15 and September 15. The recognized, qualified bog turtle surveyor will take notes and color photographs of the construction area and surrounding wetlands on a regular schedule and during any significant events or unusual circumstances.
- c. Where existing paved or unpaved roads within 300 feet of confirmed bog turtle habitat will be utilized for access without any road enlargement or improvement, a double row of silt fencing will be installed along the road, concurrent with inspection by a recognized, qualified bog turtle surveyor to ensure no bog turtles are present. A recognized, qualified bog turtle surveyor will inspect the fence for signs of bog turtle activity at least weekly for any use between April 15 and September 15. Where appropriate, directional funnels will be used to facilitate movement of turtles through culverts between wetland areas; plans for any turtle crossing will be provided to the USFWS for review and approval.
- d. Silt fencing will be buried six inches into the ground, using large stakes. Silt fencing will be installed by non-mechanical means. No equipment staging, vehicle access, or other activities will be permitted outside of the approved (silt-fenced) construction limits, other than for vegetation management as described in a., above. All silt fencing will be maintained year-round and will be inspected and maintained daily. Inspection and maintenance logs will be kept and provided to the USFWS and/or NJDEP upon request.

- e. Contractors will be trained by a recognized, qualified bog turtle surveyor on the identification of bog turtles. All contractor staff working in spans with confirmed bog turtle habitats will be required to participate in this training conducted as part of the overall environmental training, prior to entering spans containing confirmed bog turtle habitat. A protocol will be established to direct contractors as to the appropriate course of action to be taken if individual turtles are encountered within the workspace. The USFWS will be provided a copy of the protocol for review and approval.
- f. As of August 5, 2009, a guidance advisory bulletin has been issued by USFWS for all human activities occurring within bog turtle habitat. As long as the advisory guidance is in effect, all monitoring, flagging, and vegetation management activities occurring within 150 feet of confirmed bog turtle habitat will be conducted in accordance with the decontamination protocols issued in the bulletin (see attached). These practices apply to all equipment and personnel working within bog turtle habitats. Pursuant to the advisory bulletin, if any dead bog turtles are encountered during project implementation will be collected and shipped for analysis to the National Wildlife Health Center after the USFWS and the New Jersey Endangered and Nongame Species Program have been notified and apprised of the circumstance under which the turtle was found.
- g. At periodic intervals (approximately 300 to 500 feet) along the construction corridor, signage will be placed along the limits of the workspace indicating that work is occurring in proximity to designated rare species habitat. The signs will include representative photographs of bog turtles as well as a summary of the protocol to follow should one be encountered within the workspace. Signage will be removed upon completion of work in each span containing confirmed bog turtle habitat. While signage is in place, PSE&G will limit access to work crews and agency/company staff. PSE&G will inform all personnel that locations of confirmed bog turtle habitat are considered confidential and should not be disclosed verbally, in print, or electronically.
- h. If any bog turtle, live or dead, is found during habitat flagging, silt fence installation, construction, vegetation management or any other phase of project implementation, PSE&G will stop work and contact the USFWS immediately. Neither PSE&G nor its contractors, employees, or representatives will move any bog turtle except to avoid imminent danger to people or the turtle.

## **Wood turtles**

Construction-related mitigation - This species utilizes different habitat during different times of the year. They are found in streams from mid- November through mid-March for breeding and hibernation and from mid-May through mid-September they are terrestrial traveling hundreds of yards from the streams through adjacent wetlands and uplands. While in the vicinity of

documented habitat between March and November a qualified biologist should be on site with work crews to relocate any turtles found in the work area. Additional potential mitigation efforts include installation of silt fences to prevent sediment from reaching streams and seeding disturbed areas immediately upon completion of construction activities adjacent to streams. In order to ensure that water quality is being maintained, monitoring for turbidity should be conducted during and after construction adjacent to streams. In addition, no pesticides shall be used in wood turtle habitat. Avoidance of wood turtle habitat requires site disturbance activities to occur outside streams and surrounding riparian corridors. Siting of such should occur in existing edge or disturbed portions of riparian areas, so as not to fragment these corridors;

### **Longtail salamander**

Construction related mitigation - This species can be found near streams or around caves, where they seek shelter under rocks, rotting logs, or in shale banks. Maintaining riparian zones and limiting driving through streams serves to reduce impacts to this species.

### **Timber rattlesnake**

Construction related mitigation - When working in within 2 miles of known rattlesnake dens (applicable access roads and ROW segments will be identified by the ENSP prior to construction), a qualified (and ENSP-approved) herpetologist would be on site to prevent negative interactions and to relocate snakes that may wander into harms way per the ENSP protocol.

- **Access roads** – Fencing will not be used on access roads within 2 miles of known rattlesnake dens (applicable access roads will be identified by the ENSP prior to construction). PSE & G will ensure all contractors are trained to properly identify timber rattlesnakes (and northern copperheads) and will travel  $\leq 20$  mph along access roads diligently monitoring the roads for coiled and crossing snakes. Construction vehicles must safely avoid coiled snakes and wait for crossing snakes to travel across the road (keeping a distance  $\geq 15$  meters) or until the ENSP-approved construction monitor can safely move the snake from harms way.
  - Accidentally injured (or potentially injured) rattlesnakes (and copperheads) must be safely collected and released to the licensed venomous snake rehabilitator per the ENSP venomous snake protocol for construction monitors. (Please note: Snakes run over by vehicles may continue to move but have internal injuries. These snakes must be collected for medical care.)
  - Accidentally killed rattlesnakes (and copperheads) must be safely collected and released to the ENSP immediately.
- **ROW (and access roads)**
  - A fence barrier (1/4" hardware/wire mesh cloth, minimum 4' high with 5-6" embedded in the ground) will be installed along the ROW sides of the construction area. On days when no construction is occurring and each evening after the day's construction has completed, gaps no smaller than 30 meters will be created in the fence lines such that the fence lengths do

not exceed 200 meters; this is to prevent snakes from traveling long distances attempting to reach their target locations. An ENSP-approved construction monitor will survey area prior to fence installation and removal, and throughout each day during construction activities to move snakes from harms way.

- Blasting will not occur within 200 meters of known den areas (applicable access roads and ROW segments will be identified by the ENSP prior to construction).
- Identified dens will not be destroyed or altered.
- Identified gestation/birthing areas will not be destroyed. PSE &G and their contractors will adhere to the ENSP protocol pertaining to gravid and post-partum timber rattlesnakes (and northern copperheads). Active gestation/birthing areas (areas where gravid or post-partum females and/or neonates are found) will be protected from construction-related disturbances and females (and young) will not be moved. A minimum 15 meter-radius buffer around the gestation/birthing area (rock outcrop) will be maintained and an ENSP-approved construction monitor will monitor the gestation site and surrounding area frequently during construction to ensure no females or young are injured. Traveling gravid females (i.e., gravid females en route across the ROW during construction activities) in areas where no gestation areas have been identified will be moved to suitable habitat within the nearest wood line (in the direction of travel) adjacent to the ROW per the ENSP protocol. Traveling post-partum females (late August – October 31) will not be moved; construction activities will avoid disturbing such females to permit their natural path of travel.

### **Silver-bordered fritillary**

Post-construction mitigation - This species is found in wet meadows and marshes. The larval host plants are violets including *Viola glabella* and *V. nephrophylla*. This species is univoltine with one flight from June-July. Habitat for this species includes emergent wetlands for male patrol areas and larval host plants and adjacent uplands for adult nectar sources. Mitigation for this species includes avoidance of habitat during flight season and avoidance of wetlands.

### **Indiana bat**

Mitigation for this species is predominantly accomplished by limiting removal of specific tree species and establishing timing restrictions to preclude construction activities when the bats are roosting in maternity colonies. If the following conservation measures cannot be implemented for any particular, PSE&G will work with the USFWS to develop alternative site-specific conservation measures sufficient to avoid adverse effects to the Indiana bat. The following conservation measures refer to the GIS shapefile provided to PSE&G by the USFWS via e-mail on September 30, 2009.

- a) In those spans identified in the GIS as hibernacula foraging habitat (HI) and as hibernacula and maternity colony foraging habitat (HIMA) - and along access roads and



in temporary work spaces associated with such spans both inside and outside the ROW- PSE&G will maintain a seasonal restriction on cutting trees greater than five (5) inches in diameter at breast height (dbh) from April 1 through November 15, except in areas where USFWS has concurred in writing that the seasonal restriction is not necessary based on the results of a summer mist net survey.

- b) In those spans identified in the GIS as maternity colony foraging habitat (MA) - and along access roads and in temporary work spaces associated with such spans both inside and outside the ROW, and at the Roseland Switching Station- PSE&G will maintain a seasonal restriction on cutting trees greater than five (5) inches dbh from April 1 through September 30), except in areas where USFWS has concurred in writing that the seasonal restriction is not necessary based on the results of a summer mist net survey.
- c) In those spans identified in the GIS as occurring within the Geographic Range of the Indiana bat (P) - and along access roads and in temporary work spaces associated with such spans both inside and outside the ROW- PSE&G will not cut more than five (5) trees greater than five (5) inches dbh per linear mile between April 1 and September 30, except in areas where USFWS has concurred in writing that the seasonal restriction is not necessary based on the results of a summer mist net survey.
- d) In those spans identified in the GIS as hibernacula foraging habitat (HI), hibernacula and maternity colony foraging habitat (HIMA), and maternity colony foraging habitat (MA) - and along access roads and in temporary work spaces associated with such spans both inside and outside the ROW- PSE&G will flag and preserve high-suitability roost trees to the maximum extent practical, including:
  - live shagbark hickories (*Carya ovata*) over 9 inches in diameter at breast height (dbh);
  - lightning-struck trees over 9 inches dbh;
  - dead, dying, or damaged trees of any species over 9 inches dbh with at least 10% exfoliating bark;
  - den trees, broken trees, or stumps over 9 inches dbh and over 9 feet in height; and
  - live trees of any species over 26 inches dbh.In these same areas, when practical, PSE&G will girdle trees over 9 inches dbh when such trees would otherwise be cut.
- e) In those spans identified in the GIS as hibernacula foraging habitat (HI), hibernacula and maternity colony foraging habitat (HIMA), and maternity colony foraging habitat (MA) - and along access roads and in temporary work spaces associated with such spans both inside and outside the ROW- PSE&G will not install any permanent structure (e.g., access road, tower) within 300 feet of wetlands or open waters and will not clear trees or locate temporary work spaces within 150 feet of wetlands or open waters.
- f) For any replanting of temporary work spaces or compensatory mitigation, PSE&G will preferentially include the following tree species that are likely to provide suitable roosts for the Indiana bat:

[\*denotes the more commonly used roost tree species]:

Red maple (Acer rubrum)	Shagbark hickory* (Carya ovata)	White oak* (Quercus alba)
Silver maple* (Acer saccharinum)	Other hickories (Carya spp.)	Pin oak (Quercus palustris)
Sugar maple* (Acer saccharum)	White ash (Fraxinus americana)	Post oak (Quercus stellata)
Yellow birch (Betula alleghaniensis)	Green ash* (Fraxinus pennsylvanica)	Red oak (Quercus rubra)
Gray birch (Betula populifolia)	White pine (Pinus strobus)	Slippery elm (Ulmus rubra)
Bitternut hickory (Carya cordiformis)	Eastern cottonwood* (Populus deltoides)	
Sweet pignut hickory (Carya ovalis)	American elm* (Ulmus americana)	

### **T&E Plant Species**

Construction-related mitigation - A number of State listed plant species have been identified along the ROW through on site vegetation surveys. Mitigation would include avoidance and fencing of known populations of these species. Results of these plants studies are detailed within separate plant survey reports prepared for the project by Ecol-sciences under contract by PSE&G. The most botanically sensitive area of the alignment appears to be Lake Denmark. In this area, there is one existing steel lattice tower constructed on a small island within the larger swamp complex.



**PSEG Select Native Seed Mixes**  
**Prepared Specifically for the**  
**Susquehanna-Roseland 500kV**  
**Transmission Project**

**In support of Right of Way**  
**Restoration Planning and Design**

**By ERNST Conservation Seeds of**  
**Meadville, PA**

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**TRANSMISSION RIGHT OF WAY SPECIFICATIONS**

**PSEG/ERNST 01: Buena Vista Upland Seed Mix (Short)**

<b>% of Mix</b>	<b>Latin Name</b>	<b>Common Name</b>
<b>40</b>	<b>Elymus virginicus</b>	<b>Virginia Wild Rye</b>
<b>15</b>	<b>Schizachyrium scoparium</b>	<b>Little Bluestem</b>
<b>4</b>	<b>Asclepias syriaca</b>	<b>Common Milkweed</b>
<b>1</b>	<b>Asclepias tuberosa</b>	<b>Butterfly Milkweed</b>
<b>3</b>	<b>Aster laevis</b>	<b>Smooth Aster</b>
<b>7</b>	<b>Chamaecrista fasciculata</b>	<b>Partridge Pea</b>
<b>4</b>	<b>Coreopsis lanceolata</b>	<b>Lanceleaf Coreopsis</b>
<b>8</b>	<b>Echinacea purpurea</b>	<b>Purple Coneflower</b>
<b>3</b>	<b>Liatris spicata</b>	<b>Spiked Gayfeather</b>
<b>2</b>	<b>Monarda fistulosa</b>	<b>Wild Bergamot</b>
<b>5</b>	<b>Penstemon digitalis</b>	<b>Tall White Beardtongue</b>
<b>1</b>	<b>Penstemon hirsutus</b>	<b>Hairy Beardtongue</b>
<b>3</b>	<b>Rudbeckia hirta</b>	<b>Black Eyed Susan</b>
<b>2</b>	<b>Rudbeckia triloba</b>	<b>Brown Eyed Susan</b>
<b>2</b>	<b>Solidago juncea</b>	<b>Early Goldenrod</b>
<b>100</b>	<b>Total</b>	

**Seeding rates: 15 bulk lbs/acre with grain oats or grain rye at 30 lbs/acre**

### PSEG/ERNST 02: Buena Vista Upland Seed Mix (Tall)

% of Mix	Latin Name	Common Name
5	<i>Andropogon gerardii</i>	Big Bluestem
10	<i>Elymus virginicus</i>	Virginia Wild Rye
20	<i>Schizachyrium scoparium</i>	Little Bluestem
15	<i>Sorghastrum nutans</i>	Indiangrass
5	<i>Tridens flavus</i>	Purple Top
4	<i>Asclepias syriaca</i>	Common Milkweed
1	<i>Asclepias tuberosa</i>	Butterfly Milkweed
3	<i>Aster laevis</i>	Smooth Aster
7	<i>Chamaecrista fasciculata</i>	Partridge Pea
4	<i>Coreopsis lanceolata</i>	Lanceleaf Coreopsis
8	<i>Echinacea purpurea</i>	Purple Coneflower
3	<i>Liatris spicata</i>	Spiked Gayfeather
2	<i>Monarda fistulosa</i>	Wild Bergamot
5	<i>Penstemon digitalis</i>	Tall White Beardtongue
1	<i>Penstemon hirsutus</i>	Hairy Beardtongue
3	<i>Rudbeckia hirta</i>	Black Eyed Susan
2	<i>Rudbeckia triloba</i>	Brown Eyed Susan
2	<i>Solidago juncea</i>	Early Goldenrod
100	Total	

**Seeding rates: 15 bulk lbs/acre with grain oats or grain rye at 30 lbs/acre**

### PSEG/ERNST 03 Steep Slope Scenic Mixture

% of Mix	Latin Name	Common Name
1	<i>Agrostis perennans</i>	Autumn Bentgrass
5	<i>Andropogon gerardii</i>	Big Bluestem
20	<i>Elymus virginicus</i>	Virginia Wild Rye
20	<i>Panicum clandestinum</i>	Deertongue
15	<i>Schizachyrium scoparium</i>	Little Bluestem
15	<i>Sorghastrum nutans</i>	Indiangrass
5	<i>Tridens flavus</i>	Purple Top
1	<i>Asclepias syriaca</i>	Common Milkweed
1	<i>Asclepias tuberosa</i>	Butterfly Milkweed
1	<i>Aster laevis</i>	Smooth Aster
1	<i>Chamaecrista fasciculata</i>	Partridge Pea
1	<i>Coreopsis lanceolata</i>	Lanceleaf Coreopsis
1	<i>Desmodium canadense</i>	Showy Tick Trefoil
3	<i>Echinacea purpurea</i>	Purple Coneflower
1	<i>Liatris spicata</i>	Spiked Gayfeather
1	<i>Monarda fistulosa</i>	Wild Bergamot
2	<i>Penstemon digitalis</i>	Tall White Beardtongue
1	<i>Penstemon hirsutus</i>	Hairy Beardtongue
2	<i>Rudbeckia hirta</i>	Black Eyed Susan
2	<i>Rudbeckia triloba</i>	Brown Eyed Susan
1	<i>Solidago juncea</i>	Early Goldenrod
100	Total	

**Seeding rates: 25 bulk lbs/acre with grain oats or grain rye at 30 lbs/acre**

### PSEG/ERNST 04 Riparian Restoration Mixture

% of Mix	Latin Name	Common Name
2	<i>Agrostis perennans</i>	Autumn Bentgrass
8	<i>Andropogon gerardii</i>	Big Bluestem
4	<i>Carex squarrosa</i>	Squarrose Sedge
5	<i>Carex vulpinoidea</i>	Fox Sedge
20	<i>Elymus virginicus</i>	Virginia Wild Rye
15	<i>Panicum clandestinum</i>	Deertongue
15	<i>Sorghastrum nutans</i>	Indiangrass
3	<i>Asclepias incarnata</i>	Swamp Milkweed
3	<i>Desmodium canadense</i>	Showy Tick Trefoil
3	<i>Eupatorium fistulosum</i>	Joe Pye Weed
3	<i>Eupatorium perfoliatum</i>	Boneset
3	<i>Euthamia graminifolia</i>	Grass Leaf Goldenrod
1	<i>Lobelia siphilitica</i>	Blue Lobelia
2	<i>Monarda fistulosa</i>	Wild Bergamot
5	<i>Verbena hastata</i>	Blue Vervain
3	<i>Vernonia noveboracensis</i>	New York Ironweed
5	<i>Zizia aurea</i>	Golden Alexanders
100	Total	

**Seeding rates: 15 bulk lbs/acre with grain oats or grain rye at 30 lbs/acre**

### PSEG/ERNST 05 Facultative Wetlands Restoration Mixture

% of Mix	Latin Name	Common Name
3	<i>Asclepias incarnata</i>	Swamp Milkweed
3	<i>Aster puniceus</i>	Purple Stemmed Aster
5	<i>Carex comosa</i>	Cosmos Sedge
5	<i>Carex crinita</i>	Nodding Sedge
10	<i>Carex squarrosa</i>	Squarrose Sedge
20	<i>Carex vulpinoidea</i>	Fox Sedge
20	<i>Elymus virginicus</i>	Virginia Wild Rye
3	<i>Eupatorium fistulosum</i>	Joe Pye Weed
3	<i>Eupatorium perfoliatum</i>	Boneset
3	<i>Euthamia graminifolia</i>	Grass Leaf Goldenrod
1	<i>Lobelia siphilitica</i>	Blue Lobelia
3	<i>Mimulus ringens</i>	Monkeyflower
8	<i>Scirpus atrovirens</i>	Green Bulrush
6	<i>Verbena hastata</i>	Blue Vervain
3	<i>Vernonia noveboracensis</i>	New York Ironweed
4	<i>Zizia aurea</i>	Golden Alexanders
100	Total	

**Seeding rates: 15 bulk lbs/acre**

### PSEG/ERNST 06 Obligate Wetlands Restoration Mixture

% of Mix	Latin Name	Common Name
2	<i>Asclepias incarnata</i>	Swamp Milkweed
3	<i>Aster puniceus</i>	Purple Stemmed Aster
5	<i>Carex comosa</i>	Cosmos Sedge
5	<i>Carex crinita</i>	Nodding Sedge
8	<i>Carex lurida</i>	Lurid Sedge
8	<i>Carex squarrosa</i>	Squarrose Sedge
27	<i>Carex vulpinoidea</i>	Fox Sedge
2	<i>Dulichium arundinaceum</i>	Three Way Sedge
3	<i>Eupatorium fistulosum</i>	Joe Pye Weed
3	<i>Eupatorium perfoliatum</i>	Boneset
3	<i>Iris versicolor</i>	Blue Flag
1	<i>Lobelia siphilitica</i>	Blue Lobelia
3	<i>Mimulus ringens</i>	Monkeyflower
8	<i>Scirpus atrovirens</i>	Green Bulrush
2	<i>Solidago patula</i>	Rough Leaved Goldenrod
10	<i>Sparganium eurycarpum</i>	Giant Burreed
7	<i>Verbena hastata</i>	Blue Vervain
100	Total	

Seeding rates: 15 bulk lbs/acre

### FOREST ROAD RESTORATION SEEDING SPECIFICATIONS

#### PSEG/ERNST 07 Herbaceous Upland Mix For Partial Shade

% of Mix	Latin Name	Common Name
2	<i>Agrostis perennans</i>	Autumn Bentgrass
31	<i>Elymus virginicus</i>	Virginia Wild Rye
2	<i>Juncus tenuis</i>	Path Rush
65	<i>Panicum clandestinum</i>	Deertongue
100	Total	

Seed at 15 bulk lbs per acre. Add 30 lbs grain rye/acre as cover crop.

#### PSEG/ERNST 08 Herbaceous FACW Mix for Partial Shade

% of Mix	Latin Name	Common Name
15	<i>Carex scoparia</i>	Blunt Broom Sedge
5	<i>Carex squarrosa</i>	Squarrose Sedge
40	<i>Carex vulpinoidea</i>	Fox Sedge
38	<i>Elymus virginicus</i>	Virginia Wild Rye
2	<i>Juncus tenuis</i>	Path Rush
100	Total	

Seed at 15 bulk lbs/acre.

### PSEG/ERNST 09 Herbaceous/Woody Upland Mix

% of Mix	Latin Name	Common Name
2	<i>Agrostis perennans</i>	Autumn Bentgrass
5	<i>Aronia melanocarpa</i>	Black Chokeberry
25	<i>Cornus florida</i>	Flowering Dogwood
31	<i>Elymus virginicus</i>	Virginia Wild Rye
2	<i>Juncus tenuis</i>	Path Rush
65	<i>Panicum clandestinum</i>	Deertongue
100	Total	

**Seed at 20 bulk lbs per acre. Add 30 lbs grain rye/acre as cover crop.**

### PSEG/ERNST 10 Herbaceous/Woody FACW Mix Shade

% of Mix	Latin Name	Common Name
10	<i>Carex scoparia</i>	Blunt Broom Sedge
5	<i>Carex squarrosa</i>	Squarrose Sedge
26	<i>Carex vulpinoidea</i>	Fox Sedge
5	<i>Cepthanthus occidentalis</i>	Buttonbush
10	<i>Cornus amomum</i>	Silky Dogwood
10	<i>Cornus racemosa</i>	Gray Dogwood
25	<i>Elymus virginicus</i>	Virginia Wild Rye
2	<i>Ilex verticillata</i>	Winterberry
2	<i>Juncus tenuis</i>	Path Rush
5	<i>Lindera benzoin</i>	Spicebush
100	Total	

**Seed at 20 bulk lbs/acre**

For any plantings be very meticulous on the following:

- a. Control all existing weeds at the site.
  1. Do not till the site.
- b. If seed is broadcast applied, be certain to firm the seed into the soil. For small plots a lawn roller or your feet can be used.
- c. Mow the site to 8" whenever vegetation reaches 18 inches the first growing season. Failure to do so will enable weeds to smother natives and produce more weed seeds.
- d. Caution: Mowing below a height of 4 inches can kill warm season grass seedlings.
- e. Emphasize to all parties observing the test meadows that native meadows take time to mature. They often will look rather nice by growing season three, but may not show their full diversity until year 5 to 7.
- f. See Planting Specifications on the attached sheets.

Following are some general parameters for germination of native species created by Ernst Conservation Seeds' crop specialists. These parameters are applicable to restoration seedlings.

A definite protocol of germination could be carried out for the fastest germination of each species, which would involve as much as one year's pre-treatment prior to planting. It is the opinion of Ernst Conservation Seeds that the application of the seed to the site and the natural conditioning of the seeds for germination (which occurs when conditions are right) are appropriate for restoration.

This description of germination of several species in a mix is an aid in understanding these principles.

## **EXPECTATIONS OF YOUR NATIVE SPECIES**

**Germination and Growth** (all of these assume adequate light, appropriate moisture, and good seed-to-soil contact):

As a generalization, annual species have less dormancy than biennials, and biennials have less than perennials. This dormancy is nature's hedge against unfavorable conditions during the life cycle of a plant. Unfavorable conditions could be, but are not limited to, late spring frost or drought. Dormant seeds are in reserve to germinate when nature calls them "off the bench."

- Annuals -  
Most species will germinate, flower, and set seed by the end of the first full growing season. Germination of an individual species is likely to be high.
- Biennials -  
Most species will germinate, with some plants within a species population flowering and setting seed in the first full growing season. The bulk of the plants will flower and set seed in the second growing season. Germination of an individual species is likely to be lower than for annuals due to presence of seed dormancy.
- Perennials -
  1. Warm Season Grasses: Germination will occur in spring when moisture conditions are appropriate and soil temperatures at a 3" depth exceed 55° F (12° C). Best germination occurs when soil temperatures are much higher.

Most of these species do not need cold/wet stratification to produce an adequate stand. Two exceptions are *Tripsacum dactyloides* (Eastern Gamagrass), which needs 14-60 days of stratification, and *Chasmanthium latifolium* (River Oats), which needs 60 days of stratification for northern genotypes.

While cold/wet stratification is not necessary in most cases to produce an adequate stand, 20%-50% of the seed may be dormant. The vast majority of seedlings that emerge will be growing by the end of the second full growing season.

Greatest growth of these species occurs when air temperatures are 75° F-95° F. A very few (<5%) plants within a species may flower and set seed in the first growing season. The majority of growth is put into root development the first season. Maximum plant development may take five to seven years.

2. Cool Season Grasses: Some species will germinate when temperatures are a little higher than 40° F. Others will require warmer temperatures. They may germinate in fall or spring. Adequate stands of most species will not require stratification; however, 50% of the seed may remain dormant without stratification. The vast majority of seedlings that emerge will be growing by the end of the second full growing season.

Greatest growth occurs when temperatures are 65° F-85° F. With adequate moisture and nutrients, some flowering and seed set may occur in the first growing season.

3. Some sedges (*Carex alata*, *annectans*, *scoparia*, *tribuloides*, *vulpinoidea*), rushes (*Juncus canadensis*, *effusus*, *marginatus*, *tenuis*, *torreyi*), and bulrushes (*Scirpus atrovirens*, *cyperinus*, *expansus*, *polyphyllus*) have a very high seed count per pound of seed. If planted in the spring, a substantial number of seedlings may be produced by these species in their first growing season. These seedlings may represent 5% or fewer



of the total seeds present. Flowering and seed production will occur one to two growing seasons after an individual seedling has germinated. Maximum germination will take at least one year due to seed dormancy. Sedges and bulrushes will be recognizable by the arrangement of any three successive leaves in a pattern resembling the spokes in the Mercedes™ symbol. *Juncus spp* will have round stems that originate at a common point near or on top of the soil.

4. Some sedges (*Carex baileyi*, *buxbaumii*, *comosa*, *conoidea*, *crinita*, *folliculata*, *frankii*, *gynandra*, *intumescens*, *lacustris*, *lupulina*, *lurida*, *squarrosa*, *stipata*, *stricta*, *vesicaria*) and bulrushes (*Scirpus acutus*, *americanus*, *fluvialis*, *maritimus*, *pungens*, *tabernaemontani*) have a high level of seed dormancy and are unlikely to have any consequential germination without stratification. A majority of seedlings will emerge in the first and second growing seasons after they have been stratified (artificially or naturally). Plants will flower and set seed one to three years after they germinate. *Carex spp* in this group may be recognized as described above. *Scirpus spp* have round or triangular stems that arise from a point that is often below the soil surface. Stems are typically larger than those of *Juncus spp*.
5. Broadleaves: Some germination (typically inconsequential) may occur in the first year for most broadleaf species without stratification (artificial or natural). A high percentage of the species and seeds within the species are likely to germinate in the first growing season following the first winter *in situ* (on-site). A majority of the seeds that will germinate will have done so by the end of the growing season following stratification. Following germination, blooms may occur in the first growing season (*Heliopsis helianthoides*); the second (*Monarda spp*, *Rudbeckia triloba*); after three to five growing seasons (*Liatris spp*); or, not until the seventh growing season (*Baptisia tinctoria*).
6. Seed dormancy in perennial species is affected by latitude of origination for the ecotype. In green house studies, we have found that northern ecotypes (PA, OH, NY, NJ) typically require more weeks of cold/wet stratification than southern ecotypes (FL, GA, NC, SC) of the same species.

### **Life Span Of A Mix**

The majority of our native seed mixes are composed of perennial species. Mixes dominated by perennial species have the potential to persist for more than a decade if properly maintained. For all mixes, the site must be maintained to keep them free from invasive species or aggressive weeds. Mixes of herbaceous species that have no tree or shrub components in their formula must be kept free from encroachment by woody species by controlled burning or mowing.

### **Appearance Of A Mix**

The natural communities we create with native seed mixes are dynamic. Annuals, biennials, and short-lived perennials may be widely present in the landscape in the first one to three growing seasons, but non-existent or present in small pockets by the fifth growing season. Colonies of some long-lived perennials will grow larger in diameter. Species composition will change in response to annual variations of drought or heavy rainfall.

## UPLAND & MEADOW SITES

UPLAND SITES are characterized as being dry the majority of the year. Soils at these sites often consist of sandy clay and shale, very little topsoil, and are subject to drought.

Examples of UPLAND SITES:

- Naturally rocky soil that has been subject to erosion or steep road cuts
- Abandoned building sites and industrial sites

Examples of MEADOW SITES:

- Abandoned farm fields
- Previous lawns
- Vacant land
- Roadsides

## SITE PREPARATION

If your site was previously a lawn or crop field to which herbicides were applied, it is important that you allow the appropriate interval for the residues of those herbicides to break down prior to planting your meadow. Competition from invasive or undesirable vegetation is the most limiting factor in upland meadow preparation. Black plastic may be used to smother weeds in small areas before planting. Eradicate existing vegetation by having a licensed spray technician apply an approved herbicide; i.e., glyphosate (Roundup®), or tilling the weeds into the soil. Good pre-seeding weed control may require repeated tilling or spraying two applications of glyphosate (at least two weeks apart). Close mowing two weeks prior to spraying is recommended to stimulate weed growth. Glyphosate must be applied to vegetative growth in order to kill undesirable plants and their roots. The second application is needed only if the first application is insufficient. If excess dead plant material remains on the surface, burning or tilling may be necessary to achieve good seed-to-soil contact and sunlight penetration.

**Habitat:** Upland and meadow sites are generally in full sun for at least half of the day and have good air circulation.

**Fertility:** Natural fertility on these sites is generally adequate. No fertilizer or lime is needed. Check your soil pH and select species adapted to that pH.

**Seeding Method:** Hand seed, broadcast, hydroseed, or drill seed.

## GENERAL MAINTENANCE

Grassy weeds or persistent perennials can re-establish in this soil type. Monitoring and controlling weeds is essential in the first and second years. Burning (by experienced professionals) about every three years in early spring can prevent shrub invasion.

## FIRST YEAR MAINTENANCE

Observation of the desired species' growth and weed competition is essential when making maintenance decisions. When undesirable vegetation reaches 12"-18" tall, mow to no less than 6" high (with a mower or weed eater) to prevent the weeds from developing seed. Generally, native plants will grow more extensive root systems than tops in the first year; therefore, mowing to 6"-8" high will not cause harm. This practice allows sunlight to reach desired species. DO NOT MOW WITH A LAWN MOWER, as mowing too close encourages weedy grass species.

## SECOND YEAR MAINTENANCE

Mow once, close to the ground, in early spring. This allows young native plants to emerge and rapid warming of the soil. If you postpone mowing until early spring, birds and other wildlife can enjoy your native site during the winter.

## **DISTURBED SITES & STEEP SLOPES**

DISTURBED SITES & STEEP SLOPES have variable soil types and conditions.

Examples of DISTURBED SITES:

- Landfills
- Surface mines
- Road cuts
- Construction sites

## **SITE PREPARATION**

Eradicate existing vegetation by having a licensed spray technician apply an approved herbicide. Whenever possible, regrade the site to reduce slope which will, in turn, reduce erosion and minimize seed loss.

**Habitat:** Soil consists of various clay, sand, and rock outcropping without topsoil.

**Fertility:** These sites are generally low in fertility; therefore, adding topsoil or organic matter (compost) can be very beneficial. Check your soil pH and select species adapted to that pH. Add lime and fertilizer as recommended by soil analysis. Incorporate any amendments into the soil. All incorporating activities should be done in a manner that will leave the soil rough, which will minimize soil erosion and rapid run-off.

**Seeding Method:** Hand seed, broadcast, hydroseed, or drill seed. Once the seed has been broadcast, dragging with a light harrow to cover the seed (approx. 1/4"-1/2" deep), tracking, or mulching with straw, hydromulch, or straw/coconut fiber mats is recommended to protect the seed from drying out or washing away. With adequate temperature and moisture, the seed should begin to germinate within approximately three weeks.

## **FIRST YEAR MAINTENANCE**

Observation of the desired species' growth and weed competition is essential when making maintenance decisions. Minimum mowing (4"-6" high) to top off aggressive weeds is recommended to give desirable plants an opportunity to develop roots. Most of the competition the first year will be annual weeds. Mowing too close encourages weedy grass species.

## **SECOND YEAR MAINTENANCE**

Monitor and control undesirable vegetation with spot spraying or mowing. Mowing the entire area (4"-6" high) during the dormant season can enhance the appearance without jeopardizing wildlife habitat and erosion protection.

## **SPECIAL CONSIDERATIONS**

Vegetation allowed to grow without mowing provides more protection for wildlife and aids in erosion control.

## RIPARIAN SITES

RIPARIAN SITES are usually adjacent to rivers and waterways. Soils often contain clay, high amounts of organic matter, and/or saturated sand.

Examples of RIPARIAN SITES:

- River and stream banks
- Damp flood plains of rivers and streams

## SITE PREPARATION

Eradicate existing vegetation by having a licensed spray technician apply an approved herbicide, such as glyphosate (Rodeo®) or a similar aquatic herbicide formulation, to control undesirable vegetation. CAUTION: Some persistent species, such as purple loosestrife, phragmites, or reed canary grass, may need multiple applications of glyphosate. Before seeding, excess dead vegetation should be burned or turned under if conditions permit. Newly constructed riparian sites should be seeded as soon after construction as possible.

**Habitat:** Riparian sites generally vary from partial shade to full sun. These areas are often subject to flooding.

**Fertility:** Due to the potential for water contamination, the use of lime or fertilizer in riparian areas is not recommended. We do recommend the addition of organic materials when topsoil has been depleted or removed. Check your soil pH and select species adapted to that pH.

**Seeding Method:** Hand seed, broadcast, or hydroseed.

## GENERAL MAINTENANCE

Grassy weeds or persistent perennials can re-establish in this type of soil. Monitoring weeds and mowing is essential in the first and second years. Burning (by experienced professionals) about every three years in early spring can prevent shrub invasions.

## WET MEADOW & WETLAND SITES

WET MEADOW & WETLAND SITES have soils made up of clay and high organic matter, with high water tables or impervious layers that prevent drainage. They are wet most of the time.

Examples of WET MEADOW SITES:

- Roadside ditches
- Retention basins that catch run-off water
- Pond areas
- Wetland edges

Examples of WETLAND SITES:

- Newly created wetlands and wetland restoration sites
- Retention basins with wetland functions
- Flood plains, pond edges, and open water
- Wet bioremediation sites

## SITE PREPARATION

Eradicate existing vegetation by having a licensed spray technician apply an approved herbicide, such as glyphosate (Rodeo®) or other aquatic herbicide formulation, to control undesirable vegetation. CAUTION: Some persistent species, such as purple loosestrife, phragmites, or reed canary grass, may need multiple applications of glyphosate. The soil is often too wet to till. Newly constructed wetlands, retention basins, and wet construction sites should be seeded as soon after construction as possible. Leaving the surface rough by creating mounds and kettles for an undulating microtopography can be very beneficial in obligate wetlands.

**Habitat:** Wetland sites, by necessity, must have wet soil or saturated soil to standing water, a high water table, and vary from partial shade to full sun.

**Fertility:** Due to the potential for water contamination, the use of lime or fertilizer in wetlands is not recommended. We do recommend the addition of organic materials when topsoil has been depleted or removed. Check your soil pH and select species adapted to that pH.

**Seeding Method:** Hand seed, broadcast, hydroseed, or drill seed when the water table is drawn down. It is not practical to seed any wetland where the water is more than 2" deep or where severe flooding is likely to occur before germination. The same caution applies to mulching. Often, natural seed banks (seeds in wetland soil) will establish part of the vegetation cover.

## GENERAL MAINTENANCE

Very little can be done the first year. Spot treat invasives with appropriate herbicides. Burning (by experienced professionals) is an alternative to mowing every third year. NOTE: Wetland plants can often tolerate drier conditions than their indicator status.