Protocols for Conducting Surveys for Plant Species of Special Concern

Introduction

The Department of Conservation and Natural Resources (DNCR) may request a botanical survey or habitat assessment be performed to investigate proposed project sites for PA Plant Species of Special Concern. This will be used to help DCNR determine whether or not a proposed project will remove or impact a Species of Special Concern (SOSC), evaluate the level of impact to the species of special concern habitat, and identify approaches to avoiding or minimizing project-related impacts to Species of Special Concern and their habitats.

The following protocols have been provided by DCNR as a means to enhance the quality of botanical surveys conducted, as well as to standardize the way in which project areas are surveyed and findings are documented and reported to DCNR for further review. DCNR has issued that the following protocols so they may be used to guide surveyors in the field and clearly indicate the expectations of DCNR in relation to survey result reporting. The following protocols are split into four sections: 1) recommended preparation in advance of a Survey, 2) field protocols for conducting a Survey, 3) guidelines for documenting field results and report writing, and 4) Voucher specimen collection protocols.

Please also note that as of January 2011, DCNR is recommending that a Wild Plant Management Permit be obtained before conducting botanical surveys for PA Plant Species of Special Concern. Permit information and application can be found on the Wild Plant Management Program Website at: https://www.dcnr.pa.gov/Conservation/WildPlants/Pages/default.aspx and on the PNDI Environmental Review Homepage at: https://conservationexplorer.dcnr.pa.gov/.

Preparation in Advance of the Survey

***** All botanical surveyors should obtain a Pennsylvania Wild Plant Management Permit prior to surveying for any PA Plant Species of Special Concern (SOSC). The survey must address all state-listed plant species in the Pennsylvania Code Title 17, Chapter 45 listed as Extirpated, Endangered, Threatened, Rare or Tentatively Undetermined. These protocols often require collection of voucher specimens for documentation of occurrences of PA Plant Species of Special Concern. A Pennsylvania Wild Plant Management Permit is required for collection of species listed as Pennsylvania Threatened or Endangered, therefore, a Wild Plant Management Permit should be possessed by the surveyor prior to the survey date (or by the lead member of a team of surveyors). These Wild Plant Management Permits can be obtained by DCNR and are valid for one year, at which time an "update" may be sent in order for DCNR to update certification and botanists' experience. At least one Wild Plant Management Permit holder should be present in the field during each botanical survey. This permit holder will be responsible for all voucher specimen collections on site and should be the contact for DCNR to discuss content and/or results of the botanical survey report.

Pre-Survey Research

I. Familiarize Yourself with the Target Species

Surveyors should begin by familiarizing themselves with the target species included on DCNR's survey request letter. Botanical surveys should not be conducted before a PNDI review is completed; DCNR's review may provide more detailed survey information or reveal an amended species list, different from what is provided on the PNDI receipt.

A. **Review Resources:** Surveyors should used published and online resources in order to provide insight into target species' habitat requirements and taxonomic details to aid in field identification.

B. **Herbaria:** Surveyors should strongly consider visiting the appropriate PA herbaria to examine voucher specimens of target species. This will help to further familiarize the surveyor with the target species and provide practice in examining taxonomic characteristics necessary for field identification. At this time, surveyors should make prior arrangements with the Herbarium to deposit any voucher specimens of SOSC found on site during the field survey.

C. **Time of the year for Survey:** By researching the target species' phenology, the surveyors should determine the most appropriate time of the year to conduct the survey (usually, but not always, when the target species are in flower or fruit). This information is often included on the survey request letter from DCNR.

1. DCNR recognizes that waiting for the ideal time of the year to survey for a species can sometimes cause costly delays. Many times this can be avoided by conducting an online PNDI review (or sending a Large Project submission) as early as possible in the planning process. At times, even when this is done, difficulties can arise. If surveying during the ideal time

of the year is not practical, additional research may be necessary to determine the feasibility of detecting and identifying the species in vegetative condition.

2. If not surveying during the ideal time of the year, contact DCNR to discuss the appropriateness of a survey during non-peak times. If DCNR approves non-peak surveys or habitat assessments, survey reports should sufficiently describe conditions and justifications for the survey under non-ideal conditions.

3. Occasionally, a survey for appropriate habitat may substitute for a survey for one or more target species. When this is done, the surveyor (and their client) should be aware that DCNR might determine that the presence of the species cannot be ruled out based on the survey report submitted. In this case, negative impacts on the species will be assumed until a survey is conducted at the appropriate time of the year.

II. Target Species within Project Area

If DCNR's records show that a species of special concern is known to be present **within** the proposed project area, please contact DCNR for exact species locations. These known locations within the project area are provided only to botanical surveyors (who should have obtained Wild Plant Management Permits) for informational purposes only to aid in their search; this information should not be shared. DCNR cannot give out location data for occurrences of species outside the project area due to data privacy and landowner issues.

III. Prepare to Survey for all PA Plant Species of Special Concern

Surveyors should prepare for all PA Plant Species of Special Concern that share habitat requirements that could also be located within the proposed project area, even if they are not target species included with the survey request letter. In addition to target species, any and all PA Plant Species of Special Concern found within the project area should be reported to DCNR. Lists of PA Species of Special Concern sortable by County and major watersheds can be created *https://www.naturalheritage.state.pa.us/SpeciesFeatures.aspx*

IV. "Special Concern Populations" or Watch-list Species

Surveyors should familiarize themselves with the plant species that DCNR has designated as "Special Concern Populations," also referred to as "Watch-list Species." While not currently afforded any legal protection, DCNR maintains and tracks locations of these species. These species are not always species with low population numbers, but are often plants with unique characteristics, habitats or geographic range. DCNR appreciates any additional information on these species—as it aids us and the Vascular Plant Technical Committee in better understanding plant species and habitats. DCNR will sometimes request voluntary steps to protect these populations. Brief reports are appropriate for the Watch-list Species (i.e. location and a few brief comments regarding the size of the population, immediate habitat, etc.).

Surveying Protocols

I. **Survey Limits of Disturbance:** Unless instructed otherwise by the Survey Request Letter, surveyors should completely search the project area within all limits of disturbance and adjacent areas subject to indirect impacts, this includes all related secondary infrastructure (including but not limited to: access roads, pipelines, transfer stations, tower support wire anchor points, skid trails, haul roads, topsoil stockpile locations, staging areas, etc.)

II. **Sampling Procedures and Protocols:** Sampling procedures and protocols should be carefully determined in order to accurately describe all habitat types and locations within the project area.

A. Any wetlands, springs, seeps, creeks or other water bodies should be carefully surveyed regardless of the sampling process or protocol chosen for the entire project area.

B. Any ecotones or transition areas where habitat types change should be carefully surveyed for regardless of the sampling process or protocol chosen for the entire project area.

C. For smaller projects, less than 5 acres in size, the entire project area should be surveyed for any SOSC. If the surveyor deviates from this recommendation, please provide justification.

D. For projects larger than 5 acres in size, DCNR recommends a meander-style survey that is tailored to optimize investigation based on site characteristics and species' habitat requirements. The surveyor should provide justification for the sampling rationale in their report.

III. **Plant Species Lists:** During the survey, surveyors should keep a reasonably complete inventory list of all woody and non-woody plants found within the project area.

A. Every attempt should be made to identify all woody and non-woody plants present on site during the time of the year of the survey to the **species level**.

1. Identifying plants found to the genus level (e.g. Carex spp. or Cuscuta spp.) is rarely sufficient (especially if the target species are of the same genus). If you are presenting findings only to the species level, please explain why the plants could not be further identified.

2. If species can only be identified to the genus level, DCNR recommends collecting voucher specimens, when appropriate, and/or contacting other botanists or institutions to aid in identification. Please see Voucher Specimen guidelines included with these protocols.

3. If the level of identification is insufficient to determine whether the species is a SOSC, a follow-up site visit with DCNR or other PA Natural Heritage Program personnel may be required.

B. Other information regarding plant species (non SOSC) found during the survey should include:

1. Strata. (Epiphyte/liana, Non-vascular, Herbaceous, Short shrub (<1m), Tall shrub (>1m), Emergent tree, Tree sub-canopy, Tree canopy)

2. Height

3. Relative % Cover of dominant species (if it can be reasonably estimated)

4. Relative distribution across site

IV. **Site Habitat Characteristics:** DCNR also recommends keeping detailed notes regarding the following ecological and habitat characteristics during the survey. These notes should correspond with information on the "Botanical Field Survey Form" which is included with these protocols.

A. General habitat description (e.g. *Alluvial floodplain areas along Rattling Creek which are seasonally inundated by flooding. Site is mostly colonized by herbaceous species, in a mixed oak forest opening with dry-mesic soils.*)

B. Substrate/soil type. DCNR encourages any information regarding geological and soil conditions on site. Please provide as much information as your background in these areas permits (i.e., soil horizons, geology, soil types, soil hydrology, etc.)

C. Dominant plant species within each unique habitat type within the project area.

D. Any other observations that the surveyors feels are important to help the reviewer gain a better understanding of the site and how it will be impacted by the proposed project.

E. Color photographs of the areas surveyed are also particularly helpful.

V. **Target Species Data Collection:** When recording information regarding PA Plant Species of Special Concern (SOSC) found on site, please make observations regarding:

A. Location information. This includes: specific directions to the site, name of site owner (and leasee if applicable), and GPS coordinates (if possible, please provide both decimal degrees and degrees/minutes/seconds).

1. For small populations, GPS center point and radius necessary to enclose entire population is sufficient. If the radius is greater than 6.25 meters, a polygon is preferred.

2. For large populations GPS multiple points around the population perimeter so that a polygon for the population can be drawn.

3. Include a hand-drawn map showing the limits of the population. This is important if unable to obtain GPS data. Include features that are likely to serve as permanent landmarks to facilitate relocation of the population.

B. Observations regarding the condition of the surrounding habitat. Consider the specificity of the plant's requirements as well as the rarity of the element when deciding detailed a description is appropriate.

1. Associated Species

   a. Only include plants and trees that are growing near the element and in the same habitat. A good rule of thumb is herbaceous plants within 1 meter, and woody plants within 5 meters, excluding other habitats. However, unless you are involved in a quantitative study (in which case you should probably be recording data in a different format), this usefulness of this data will be related only to the extent to which it helps to describe the habitat of the element at this location. (If you are in a fen that is dominated by *Carex interior*, but the nearest stem of that species is just over a meter away, you should probably include it as an associate unless you have some reason to think the *C. interior* is excluded from the immediate vicinity of the element because of habitat differences).

   b. Animal species should be included if interaction with the plant element is known or suspected. Such interaction can be indirect, such as an animal that is significantly defoliating a dominant species in the habitat.

2. Relative age or Successional stage

3. Topographical features including aspect, slope, elevation and topographic position (ridge, steep slope, floodplain, etc.)

4. Light conditions. This may include observations regarding canopy cover and shading.

5. Moisture conditions. This would also include hydrologic conditions or proximity to any water sources.

6. Any known or inferred land use (present and past)

7. Any other anthropogenic or unnatural disturbance

8. Integrity/Fragmentation of the plant community

9. Presence of any invasive species (or native vegetation acting aggressively) occurring on site

10. Any threats on-site (routine mowing, succession, invasive plant colonization, etc.) or off-site (development, mining, climate change, etc)

11. Other members of the genus that occur on site, please also note any evidence of hybridization. If hybridization is common in the genus, express your level of confidence regarding the presence of hybrids in the

area. If any other species in the genus are present that might plausibly hybridize with the element, list them.

C. Substrate/soil type. DCNR encourages any information regarding geological and soil conditions on site. Please provide as much information as your background in these areas permits.

1. Indicate the depth or depths at which you observed the soil. If your understanding of soils permits, express this in terms of soil horizons.

2. Geology and soils types can be determined from maps geology or soil survey maps as well as from direct observation, both with inherent limitations on accuracy. Specify which. Of course, it is best to have both, but this is not always necessary.

3. Please also indicate any observations relating to soil hydrology.

E. Estimates of additional area of potential habitat for the SOSC. DCNR is interested in notations concerning areas of potential habitat where SOSC are not currently found, but provide the appropriate conditions for possible colonization in the future. Please keep careful notes so that potential habitat can be discussed in your report and these delineated areas can be included with other maps.

F. SOSC biology and population information

1. Phenology (e.g., in leaf? In bud? In flower? Immature or mature Fruit? Seed dispersing?).

a. If a population exhibits more than one phenological state, please note all that apply (include percentages if relevant to assessing the age or health of the population).

b. If flowering, please indicate whether the plant may have flowered earlier or later than normal. Please make careful observations that relate to how well a population is reproducing and the long-term viability of the population.

c. For bryophytes and pteridophytes, indicate appropriate phenology. This consists of leaf vs. states of sporangia, but it could also include gametophyte phenologies, which are important and often overlooked. Always look for gametophytes when assessing an occurrence of a pteridophyte.

d. Note if vegetative propagules, such as gemmae, turions, bulbils, or adventitious deciduous shoots are present.

2. Size of Element Occurrence (EO) of SOSC

a. Definitions

i. Genet: "*A unit or group derived by asexual reproduction from a single original zygote, such as a seedling or a clone*" (Lincoln, et Al, 1998). A genet can consist of a single stem or a clone of many stems that are essentially genetically identical.

ii. Ramet: "*A member of modular unit of a clone, that may follow an independent existence if separated from the parent organism*" (Lincoln, et Al, 1998). This is a useful concept for evaluating the size of occurrences because determining the number of genets in the field for an asexually reproducing species is often not possible, and the number of stems or clumps (ramets) can be a better indicator of viability than the number of genets.

b. Counting

i. It is inadvisable to estimate the number of plants without counting a portion first. There is a tendency to significantly underestimate occurrence size.

ii. Count a reasonable number of plants (25 or 50) and to gain a sense of what this many plants looks like. If this is small relative to the whole occurrence, visually extrapolate to estimate what 100 plants looks like. While mentally adjusting for differences in density, use this basic unit as a template, and walk around the occurrence adding up the number of units to obtain an estimate. **Please include exact numbers whenever possible.**

iii. Counting a clonal species

a). A large portion of our native plant species are clonal by rhizomes. If possible, estimate both the number of genets and the number of ramets.

b). Estimating number of genets. Plants that produce multiple or branched rhizomes tend to form more or less circular clones. As these clones age, they may merge, making it difficult to determine how many genetically unique plants are present.

- Look for somewhat circular patterns in the distribution of stems.
- Look for slight differences in color (especially in the fall) or phenology; individual plants show unique characteristics as one would expect from animals, although typically the differences are more subtle.

- Document how you obtained your estimate. An estimate based partly on speculation can be useful if (and only if) the nature of the speculation is known.

c). Estimating number of ramets.

- A plant ramet is usually either a stem or a clump. Clumps can also be genets though, and field workers do not always have the resources at hand to make this determination.
- Count clumps if it is reasonably clear what constitutes a clump. This is the most useful way to keep track of the size of an occurrence whether or not the clumps are connected by rhizomes.
- If you are counting clumps, it can be useful to estimate the average number of stems in a clump. This is especially important for loosely tufted species, when what constitutes a clump can be subjective.

c. It is important to distinguish between ramets and genets by estimating occurrence size in a repeatable way and clearly documenting your method. **Make sure it is clear what was counted as a ramet or a genet.** In this way, someone can later deduce whether the occurrence is declining, stable, or increasing by reproducing your method.

3. Estimate of population area. Surveyors should be sure to have carefully delineated the furthest extent of a population and all **additional potential habitat** that exists in the vicinity of the population. This should include areas inside and outside of the project area when possible.

4. Age structure. This may be ignored for annual species. When using "mature" be sure that you are referring to reproductive maturity.

   a. Age structure observations should help assess how well the population is regenerating (e.g. % seedlings, % immature, % 1st year, % mature, % senescent)

   b. If you are documenting a perennial species and can find few or no juveniles, this is important to note; and you should then consider whether there might be any disruptions in the life cycle such as:

      i. Absence of obligate pollinators

      ii. Absence of male or female plants (for dioecious species).

iii. Lack of multiple genets (for partially or completely self-incompatible species).

iv. Excessive herbivory on reproductive parts.

5. Vigor of population (e.g. very feeble, feeble, normal, vigorous, exceptionally vigorous). If you don't have the experience to provide the appropriate evaluation, please note this before omitting these observations.

6. Look for evidence of animal pollinators (if applicable) and dispersers. Pollination biology is often a significant gap in the understanding of the ecological requirements of rare plant species.

7. Evidence of Disease, Predation or Injury (if present)

8. Any other observations of note, including any insights into how well or poorly the species may be reproducing.

G. An explanation of any identification problems and any references used to aid in identification, if identifying this species during non-peak time, a methodical explanation of how a species was taxonomically identified should be included.

H. SOSC population size relative to other occurrences you have observed (if any)

VI. In addition to target species, any and all PA Plant Species of Special Concern found within the project area must be reported to DCNR. This includes all PA Watch List or "Special Concern Populations" (SP) species.

VII. Voucher Specimens. Voucher specimens can be valuable as a way to confirm plant identification after a study has been completed. In order to collect a voucher specimen, the collector **MUST** have a Wild Plant Management Permit. In addition, decisions regarding when to collect a Voucher Specimen of a PA SOSC and how to collect these plants are outlined in the "Policy on Voucher Specimens" included with this protocol. Surveyors must also note where voucher specimens were sent. A list of PA herbaria locations is also included with the "Policy on Voucher Specimens."

VIII. If SOSC **were not found** please prepare detailed notes that reflect the following

A. How the proportion of the project area surveyed (if not surveyed in its entirety) was sufficient to have found the SOSC had it existed on site.

B. Disturbances that could have effected a previously present population

C. Any areas of unsuitable habitat for SOSC

D. Plant competition (notably invasive exotics)

XI. Surveyors are also encouraged to make observations and compile notes that may be relevant to the specific type of project proposed and any other insights or observations not captured above.

Preparing the Botanical Survey Report

I. Notation and Titling – Cover Page

A. Surveyors should include the PNDI number and Project name (as it appears on the initial botanical survey request letter) on the cover page. Please clearly indicate that this is a "Botanical Survey Report."

B. The survey report should be clearly addressed to the environmental reviewer who sent the initial botanical survey request letter. The appropriate mailing address for these reports is as follows:

> Mr./Mrs. Environmental Reviewer Name
> PA Dept. of Conservation of Natural Resources
> Bureau of Forestry Ecological Services Section, PNDI
> PO Box 8552
> Harrisburg, PA 17105-8552

C. The cover page should also include the company or organization for whom the botanical survey was conducted.

D. The cover page should also indicate which PA township(s) and county(s) the botanical survey took place.

II. Introduction

A. Clearly indicate the survey's target species.

B. Indicate when the survey was conducted

C. List who conducted the survey. All personnel present during the survey should be noted. Please also list all Wild Plant Management Permit Numbers (when applicable).

D. Please also list other SOSC that the surveyor(s) may have been searching for and why these species were included.

E. Optional: You may quickly summarize the results of the botanical field survey here if desired (e.g., "*ABC Botany located a population of Viola appalachiensis along the proposed pipeline route; in addition, while no individuals of Oxypolis rigidior were found, there were two areas of potential habitat, totaling approximately 2 acres."*

III. Methodology

A. Please justify the time of the year that the survey was conducted in regards to identifying the target species.

B. Please carefully explain your sampling methods used to adequately survey the proposed project area. This should include a short narrative of how the survey progressed across the site. Also give reasoning for leaving out any habitat types from the survey (active agricultural field, manicured lawn, etc.).

C. Please explain what botanical references were used to aid in field identification or if any additional botanist contacts were made to discuss identification.

D. Surveyors should include any pertinent information regarding any previous field experience with any of the target species (preferably within PA) and any previous botanical experience in that particular portion of the state.

VI. Results

A. Data security and confidentiality.

1. All data collected during a Botanical Survey should be shared with clients, landowners, PA Herbaria (or museums), and DCNR's Bureau of Forestry. Due to the sensitivity of this data, it should not be shared further.

2. DCNR submits all data pertaining to SOSC and Special Concern Populations (SP) species to the PA Natural Heritage Program Database.

B. Habitat type(s) encountered. Surveyors should carefully explain all habitat types encountered within the project area. All habitat types and SOSC found should also include references to photographs and figures included in the survey report.

1. This explanation should include how common each habitat type was, as well as, the dominant plant species within each type.

(*"Regenerating forest/Abandoned Pasture – The dominant tree species in the regenerating forest/abandoned pasture habitats included red maple and wild black cherry. Dominant mid-story trees and shrubs included: hawthorn (Crataegus puncata), blue beech, hop-hornbeam, blackberry, and multiflora rose. The dominant herbaceous species included white grass (Leersia virginica), Virginia wild-rye (Elymus virginicus), white avens (Geum canadensis), dwarf cinquefoil, and poverty grass (Danthonia spicata). Tree-of-heaven (Ailanthus altissima) was found within this habitat type. This habitat was found along the southern third of the project, covering approximately 10 linear acres")*

2. If any Target Species or other SOSC are found within these habitat areas, please note that within the habitat description

(*"Floodplain in Beech Forest – The portion of Middle Creek within the project area occurred in a beech forest. Creeping bluets (Houstonia serpyllifolia), a Pennsylvania SOSC was observed along the bank. This species was not listed as a target species for the survey.*

The dominant tree species included beech, yellow birch, witch-hazel, and red maple. The dominant shrub –level species included beech and red maple. The dominant herbaceous species included tussock sedge (Carex stricta), white grass, clearweed (Pilea pumila), stonecrop (Sedum ternatum) and zig-zag aster (Symphyotrichum prenanthoides). No invasive plant species were found in this habitat. This habitat type was only found within 200 feet of either side of Middle Creek")

3. Please see "Survey Protocols" section for all additional habitat observations that should be included in the results section.

C. Narratives regarding any and all PA Plant Species of Concern found on site. Please see "Survey Protocols" section for all observations that should be included in the results section when describing SOSC found on site.

D. If SOSC were not found on site, please prepare a detailed narrative that explains the following:

1. How the proportion of the project area surveyed (if not surveyed in its entirety) was sufficient to have found the SOSC had it existed on site.

2. Disturbances that could have effected a previously present population

3. Any areas of unsuitable habitat for SOSC

4. Plant competition (notably invasive exotics)

5. Any "potential habitat" that was found on site, but in which no SOSC were found.

E. A list of all woody and non-woody plant species present at the site during the time of the year of the survey, identified to the **SPECIES** level should be included here. This list, if possible, should be split by habitat types described in the results section. This list should be as reasonably complete as possible. If species cannot be identified to species level, please explain these difficulties in identification.

VII. Justifications and Recommendations. In current survey reports, the statement, **"We don't anticipate any impacts to these species as a result of this project"** is often used to conclude the report. DCNR would prefer a more thorough discussion of the justifications for such a decision. Whether or not SOSC are found on site, opinions, and recommendations regarding the potential for negative or any positive impacts should be **thoughtfully considered and substantiated** based on field observations and proposed project details. Surveyors should attempt to address both direct and indirect impacts to SOSC and any potential habitat areas over the short- and long-term as a result of the project.

A. If SOSC were found within the proposed project area surveyors should provide some commentary regarding how the proposed project would impact SOSC found on site. **Please be as specific as possible** regarding distances and construction protocols. If the surveyor has any previous experience with this species, please

provide that information as well. When possible, please provide a number of options that you feel may or may not work to protect the SOSC and their potential habitat(s), with justifications. Some examples follow (other formats are acceptable):

Species found, but not likely to be impacted by project:

("Oxypolis rigidior was found adjacent (approximately 200 feet from the edge) to the proposed pipeline route in a wet, shrub dominated, forested edge habitat, however, since it was outside the proposed construction right-of-way, this population is unlikely to be directly affected by construction. The spring seep creating the hydric conditions near the O. rigidior population will not be impacted by construction, which should prevent any noticeable changes in hydrology near the population. There are unlikely to be any indirect, negative impacts as a result of this project. I have been told by my client that this population, as well as the spring seep, is outside the leased right-of-way area and will not be subject to any right-of-way maintenance activities. At this time, I do not recommend any changes to the proposed route or construction protocols. However, I would encourage my client to follow careful procedures such as: washing all vehicle and equipment wheels and undercarriages and using weed-free straw when re-seeding, to avoid colonization by invasive plant species.

This surveyor has also seen O. rigidior growing in a small shrub wetland immediately adjacent to a roadside ditch in Somerset County, as well as a larger population in Forbes State Forest in Fayette County. The Fayette county population was found in a wet, bottom land forest with numerous shrub openings. Habitat conditions in both the surveyed population and the Fayette county population appear to be similar. The Somerset County population while subject to occasional indirect disturbance, appeared to be setting seed (perhaps successfully reproducing?). If the Somerset County population is indicative in any way of the tolerance of O.rigidior of less-than- ideal growing conditions (due to roadway runoff and potential pollution and road maintenance activities), it may further indicate the relative viability of the surveyed population, given its stable habitat which is unlikely to be affected by the proposed right-of-way construction.

-or-

Species found, minor adjustments to the project activities necessary to ensure no negative impacts:

(*"Platanthera ciliaris was found along the roadway in a periodically maintained road shoulder (approx 10 feet from road surface) within the State Forest in a sphagnous, wet depression. If the road surface improvements (re-paving, road grading) can remain within the existing road footprint and not impact the road shoulder areas, negative impacts could be avoided. In addition, as long as mowing of the road shoulder occurs very late in the season (September 1st or later), after seeds have matured and dropped, reproduction of this species should*

not be disrupted by road maintenance activities. We would encourage DCNR to recommend a maintenance schedule that includes specific times of the year for mowing (if necessary) and restricts any herbicide spraying within the known habitat and potential existing habitat for this species.

The surveyor has experience examining P. ciliaris within existing utility and road ROWs. Often, the open conditions created and maintained within the ROW provide favorable conditions for P. ciliaris to persist from the seed bank or dispersal from nearby populations. When maintenance activities, such as mowing or herbicide, are completed during periods when this species is not actively growing, flowering, or setting seed, the populations do not appear to be negatively impacted. Some level of disturbance appears to be benefiting this species by lessening competing vegetation encroachment and providing open conditions for optimal flowering. This may be important in this particular instance for the long term viability of this population, since it appears that the periodic mowing is preventing Kalmia latifolia from encroaching from the forest to the road shoulder. However, maintenance activities may inadvertently cause the spread and persistence of non-native invasive species, and each case should be reviewed for unanticipated negative impacts of maintenance activities on this species.")

-or-

<u>Species found, major adjustments to the project activities necessary to avoid negative impacts:</u>

(*"Cypripedium reginae was found within a high-quality fen habitat that is bisected by the proposed pipeline route. We recommend re-routing the pipeline to entirely avoid this fen and to provide at least a 1000-foot no disturbance buffer from the furthest extent of any construction activities and the final right-of-way route. Directional boring is not recommended in this case. While it may protect this species from any impacts due to construction, it may be difficult to ensure that ROW maintenance in the future would not impact this species negatively. Due to the high quality nature of this habitat, it is the opinion of the surveyor that DCNR should recommend complete avoidance and at a distance deemed sufficient to avoid any direct or indirect impacts.)*

B. If additional studies are necessary, please indicate this here and explain any justifications.

C. If no SOSC were found, but potential habitat for these species of concern was found on site, please indicate what (if anything) should be recommended to help protect or improve this habitat.

D. Please include contact information (phone number and email) so that DCNR can contact the surveyors to discuss the results of the survey if necessary.

E. Signatures. All personnel whom conducted the botanical survey and have Wild Plant Management Permits should sign the botanical survey report. This indicates

their concurrence with the included information and recommendations as well as verifies that all information included is as accurate as possible.

VIII. Attachments and Appendices

A. Maps and Figures. Maps of the entire project area that indicate all areas surveyed as well as locations of any and all SOSC found on site. Figures should also be included that clearly illustrate any SOSC individuals and populations and where they were found. Ideally, these maps would be provided in color as both topographical maps and aerial photography. Please carefully delineate all habitat types encountered and all areas surveyed / not surveyed on all maps.

B. Site Photos.

1. Color photographs should be included that are representative of all habitat types encountered.

2. Color photographs of any SOSC encountered during the survey should be included.

a. Detailed photographs that aid confirmation of plant identification

b. Photographs that show any SOSC and their surrounding habitat

3. Please be sure in the Maps and Figures section to include a map with points indicating where pictures were taken.

C. Wetland delineation data sheets (if applicable)

D. Copies of any correspondence with other botanists regarding SOSC identification, either pre- or post-survey.

E. Copy of PNDI receipt and botanical survey request letter

F. PA SOSC Field Survey Forms (along with maps and photographs, these data sheets are submitted to the PA Natural Heritage Program to be added to our records). A separate Field Survey Form should be submitted for every SOSC population found on site.

G. Any other information, lists or figures that the surveyor deems as important

H. A copy of the surveyor(s) Wild Plant Management Permit. This will enable DCNR to review the surveyor's qualifications by referring to the Wild Plant Management Permit application on file. If the surveyors have not obtained a Permit, a resume and statement of qualifications should be attached.

I. GIS Shapefiles of the entire area project area surveyed. (Optional)

Literature Cited

Lincoln, Roger, Geoff Boxshall, and Paul Clark. 1998. A Dictionary of Ecology, Evolution and Systematics, 2nd ed. Cambridge University Press).

Portions of this protocol were taken from: Grund, S. 2004. Documenting Plant Element Occurrences for the Pennsylvania Natural Heritage Program.

Policy on Voucher Specimens

Voucher specimens should be collected for all biological studies involving plants in Pennsylvania. The preferred voucher specimen is a pressed and dried plant specimen with reproductive parts (flowers, fruits, spores) prepared using standard botanical collecting methods. For smaller herbaceous plants the entire plant, including the roots, should be collected. Representative portions of large herbaceous plants should be pressed as well as a piece that includes the lower stem and roots. Twigs or small branches with fruits or flowers comprise a standard specimen for woody plants, such as trees and shrubs.

These guidelines apply to populations for approximately 20 or more herbaceous plants and to well-established single trees or shrubs. Although discretion should be used in the case of frequently visited populations of rare, threatened or endangered plants as it may not be necessary to document each observation with a specimen. In situations where collecting a standard voucher specimen may be detrimental to the reproductive success of that population or may be difficult to obtain, the following will serve as the required voucher (listed in decreasing order of preference):

1. Portion of fertile plant without the root.

2. Photograph of plant in conjunction with piece of fertile plant or plant parts (leaves and flowers or fruits). Photographs should be black and white and printed on archival paper.

3. Photograph of fertile plant in conjunction with sterile plant specimen.

4. Sterile plant specimen only, or photograph only.

Regardless of what type of voucher is collected, all vouchers must include the following collection data:

1. Collector(s) – At minimum, first initial and last name spelled out; full name is preferred.

2. Collector number – A unique number associated with a specific collection and usually given as a sequential number in a series made during a collector's lifetime. Numbers which apply to more than one plant collection (e.g. survey numbers) should not be used.

3. Date of collection – This should include day, month and year with month spelled out to avoid confusion.

4. Locality – At minimum, county and approximate mileage from some specific landmark readily found on available maps. Distance is given in compass directions (N, NNE, ESE, etc.). Additional more specific locality may be included after the basic mileage. Example: Fayette County, 2 km NE of Chalk Hill, road crossing Deer Lake.

We strongly recommend that additional information such as, but not limited to, the following be included:

5. Altitude – Approximate altitude either measured in the field or taken from map, expressed in feet or meters.

6. Latitude and longitude – Expressed to the nearest second.

7. Name of the USGS Quad map on which the site is located.

8. Habitat – Brief description of habitat.

9. Field notes on the plant – any feature of the plant which will be lost upon pressing and drying such as flower color, fruit color and shape, height of the plant (if entire plant was not collected), and plant habit.

Voucher specimens should be deposited in a herbarium in Pennsylvania.

Policy approved by the Vascular Plant Technical Committee of the Pennsylvania Biological Survey, March 21, 1992.

PA Herbaria Accepting Voucher Specimens

(Please contact the Herbarium of your choice before sending the voucher specimens)

The John F. Lewis Herbarium at the California University of Pennsylvania

Robert S. Whyte, Ph.D.
Asst. Prof., Biological and Environmental Sciences
250 University Avenue
California, PA 15419
(724)-938-5955
Whyte@cup.edu

Carnegie Museum of Natural History Herbarium

Bonnie L. Issac
Collection Manager, Section of Botany
4400 Forbes Avenue
Pittsburgh, PA 15213
(412)-622-3253
IsaacB@CarnegieMNH.org

Shippensburg University Herbarium

Larry Klotz
Department of Biology
1871 Old Main Drive
Shippensburg, PA 17257
(717)-477-1402
lhklot@ship.edu

Morris Arboretum Herbarium

Timothy A. Block
Morris Arboretum, Univ. of Pennsylvania
100 East Northwestern Avenue
Philadelphia, PA 19118
(215)-247-5777 ext 130
block@exchange.upenn.edu

Academy of Natural Sciences of Philadelphia

Dr. Tatyana Livshultz (Primary)
Assistant Curator of Botany
1900 Benjamin Franklin Parkway
Philadelphia, PA 19103
(215)-299-1051
livshultz@ansp.org

Alina Freire-Fierro (Secondary)
Collection Manager of Botany
1900 Benjamin Franklin Parkway
Philadelphia, PA 19103
(215)-299-1157
freirefierro@ansp.org

James C. Parks Herbarium at Millersville University

Chris Hardy
Biology Department
50 E. Frederick Street
Millersville, PA 17551
http://herbarium.millerville.edu

Additional requests for submitting specimens to Millersville University Herbarium:

1. Pressed and completely dry, either simply loose between a single folded newspaper sheet or mounted onto herbarium paper.

2. Each specimen must be accompanied by an approximately 3x5 inch paper label (preferably on acid-free paper) that includes the following: (1) Name of Species; (2) Locality; state, county, township, precise description of the locality and habitat, GPS coordinates are optional; (3) Date Collected; (4) Collector name and collector's number of collection (e.g. "Jane Smith 103" is Jane Smith's 103rd collection); (5) Name of project for which plant was collected; (6) Description of plant such as height, flower color, abundance, etc.

3. Shipping is usually done via "library rate" via standard postal service. The specimen package is supported by two sheets of 11 x 16 inch corrugated cardboard, and then this is wrapped in brown postal paper. Alternatively, many specimens can be sent in a box.

4. Finally, the specimen(s) should be accompanied by a signed letter detailing the contents of the package.

Tips on Plant Collecting and Drying

Collecting, labeling, mounting and curating plant specimens is a time-consuming and expensive process, and collections should be prepared in the field with the later effort in mind. Specimens which are prepared correctly in the field vastly increase the efficiency of processing those specimens. Obviously, there are times when a "perfect" specimen is impossible, but the goal should be to produce the best specimens possible.

Top Snatching
The ideal herbaceous plant specimen is the entire plant, including the roots. Clipping off the tops of plants may be easier, but does not produce quality specimens. If the plant is too large to fit on one sheet, possible options include:

- Section and press plant to be mounted on more than one sheet
- Trim plant to fit on one sheet, but be sure to include representative basal, middle and upper portions. Remember to include the total height of any plant cut into pieces in your field notes.

Size of Specimens
A common mistake is pressing a specimen which is too large to fit on standard herbarium paper. Pressing specimens which are too big to be mounted may be easier for the collector in the field, but it only produces problems for mounters, who may not know which parts of the plant are expendable. Remember that in addition to the plant, room must be left for a label in the lower right-hand corner and also for the herbarium logo and sheet number in the upper right-hand corner.

In addition to pressing specimens which exceed the dimension of a standard herbarium sheet, many collectors also try to put too much plant material on a single sheet. Take time in the field to trim and arrange plant specimens, checking especially for overlapping leaves and thick stems or fruits. Don't try to fit more on a herbarium sheet than it can hold; this practice only obscures the plant and reduces the scientific value of the specimen.

Quantity is not Quality
Many snippets of a plant don't replace one quality specimen and, in fact, create more work for plant mounters who must handle each piece individually. The end result is a low-quality specimen, which has taken more time to prepare, and thus ends up costing more than a top-quality specimen. Attempt to collect one piece which includes leaves, fruits and/or flowers. Include extra pieces only when it adds scientific value to the specimen.

Dirty Specimens
Dirt left in specimens, especially in the roots, causes problems both during the mounting process and also in later handling of mounted specimens. Excessive dirt left in specimens contaminates the glue tray being used, and thus forces mounters to wash that glue tray and start anew. Excessive dirt on mounted specimens continually falls off, potentially causing damage both to the culprit specimen as well as its near neighbors. It is much easier and less damaging to the plants to remove dirt from roots before the specimen is dried.

Drying
Dry the specimens as quickly as possible. Specimens left in the press without being dried tend to either mold or form abscission layers which allow the leaves to fall off in the mounting process. Small heater fans are widely available and when used in conjunction with a box can dry most specimens within a 24 hour span. Place plants in the press in a manner that the plant is not several layers thick and with as little overlap as possible. Place all specimens so that the open end of the newspapers will point toward the ceiling when the press is on the dryer. This reduces the possibility of plant parts falling into the dryer. Make sure that the press straps are tight before placing the press on the dryer, remembering that the press will loosen as dries. A loose press allows for plants to wrinkle as they dry.