NATIVE LANDSCAPE & ECOLOGICAL RESTORATION GUIDE

Recommendations for Contractor Selection, Project Specifications, Performance Standards, Monitoring and Management Guidelines, and Institutional Arrangements

Prepared by the Native Landscape & Restoration Contractor Selection Guide Working Group

ABOUT CHICAGO WILDERNESS

Chicago Wilderness is a regional alliance leading strategy to preserve, improve, and expand nature and quality of life. By connecting leaders in conservation, health, business, science, and beyond, we tackle challenging issues to ensure a resilient region.

Building on a 20-year legacy of collaboration, our broad alliance of member organizations advance work in Illinois, Indiana, Wisconsin, and Michigan.

Chicago Wilderness leverages members' collective strengths to drive one regional strategy through the following focused efforts:

Oak Ecosystems: ensuring a future for oaks and their ecosystems
Priority Species: conserving a targeted group of species that benefit our region's lands and waters
Water as a Resource: addressing regional water issues through conservation action
Landowners: engaging landowners in conservation action
Beyond the Choir: building and sustaining a broad, representative, and active constituency
Data & Member Tools: applying technology and data to accelerate collaboration

Using this cross-disciplinary and measurable approach, Chicago Wilderness addresses critical challenges and inspires meaningful change. We harness adaptive and innovative thinking, apply solid science, and connect diverse constituencies.

Learn more at **www.chicagowilderness.org**.

Purpose and Background

A primary purpose of this Guide is to provide direction and assistance to organizations that may have less experience in the selection and oversight of appropriate contractors and consultants for native landscaping and ecological restoration work. Another purpose is to provide guidance and criteria to ensure that ecological restoration and native landscaping projects will be ecologically sound, sustainable, and attractive within a reasonable timeframe. Consultant and landscaping firms without experience and expertise in native systems can often mislead organizations seeking to implement native landscaping and restoration projects which can lead to project failure loss of investment. Successful installation and care of native landscapes and ecological restoration requires a wholly different skill set, tools and considerations than those used in traditional manicured landscape design, installation, and maintenance.

The specific goals of this Guide are to enable these organizations to: 1) facilitate the selection of qualified contractors or consultants to design, install and/or steward native landscapes; 2) set ecological restoration goals and expectations; and 3) objectively evaluate the work done by the contractor, their progress toward goals, and completion of projects to ensure that the ecological and aesthetic expectations are met.

A discussion of various tools is provided in this document, which include:

1. Minimum firm qualifications and experience
2. Specifications for projects
3. Performance standards (goals and objectives)
4. Monitoring and management guidelines
5. Institutional arrangements (e.g., ownership, conservation easements, back-up SSAs, bonding, other securities, etc).

The purpose or goals of the individual project will influence the weighing of specific factors in making a contractor/consultant selection and will be considered in each of the 5 guidance tools listed above. For this Guide, we will consider the following primary purposes for a project:

1. Ecological restoration of a remnant or re-establishment of a native community
2. Native landscaping for aesthetics and as a green infrastructure best practice
3. Native landscaping for stormwater management and water quality purposes

While some overlap may exist, any given project will most likely have one or more of these three as the driving project purpose. This is especially important when considering performance standards.

Programs and Initiatives to Inform this Guide

Midwest Ecological Landscape Alliance – This is an ongoing group with an effort to define "preferred providers" in a broader sustainable landscapes context. See their web page at http://www.melaweb.org/ for more information. It is intended that their efforts will dovetail with and utilized this Guide.

Northeastern Illinois Planning Commission (NIPC)(now part of CMAP) and Chicago Wilderness: NIPC, in cooperation with Chicago Wilderness and Corporate Council members, developed *Natural Landscaping for Public Officials: Design and Management Guidelines* (2004). These guidelines address design, installation, post-installation management, and maintenance of natural landscapes. http://www.chicagowilderness.org/files/9013/3087/4874/installation_maintenance_guide.pdf .

Another possible resource are local ordinances such as the McHenry County Conservation Design Ordinance. This ordinance, similar to other ordinances in Algonquin, Crystal Lake, and Woodstock, addresses restoration and native landscaping specifications and performance criteria, monitoring and management criteria, and institutional arrangements. It is available at: http://www.co.mchenry.il.us/departments/planninganddevelopment/Documents/Ordinances/Conservation%20Design%20Addendum.pdf

Target Audience

The target audience for this Guide is any landowner that wants to establish, restore, or oversee a native landscape or ecological restoration. It is targeted to organizations and individuals needing to hire someone for ecological restoration or native landscaping, but who may lack the experience to seek and adequately judge proposals and make an appropriate selection. It is also targeted to entities who take on the responsibility to evaluate and ensure the immediate- and long-term success of restorations and native landscape installations. This Guide is specifically developed for:

1. Homeowners Associations
2. Property Owners Associations
3. Individuals, private institutions, and businesses
4. Building Managers (and associations thereof)
5. Developers
6. Development Consultants/Contractors
7. Park Districts that are not already experienced in such matters
8. Municipalities not already experienced in such matters

This Guide utilizes the experience and lessons learned from the various Forest Preserve Districts and ecological restoration consultants and contractors from the

Chicago Wilderness Corporate Council. This Guide is not intended to offer any further information or guidance to these more experienced organizations.

Minimum Firm Qualifications and Experience

In evaluating a contractor's qualifications to bid on and complete a native landscaping or ecological restoration project, each firm should be required to provide examples and references of work that is similar in scope and has been successfully completed. A request for qualifications should essentially be a part of any request for proposals unless you are already familiar with the firm and are confident they have the appropriate expertise with native Midwestern systems. This should include their years of experience doing work with NATIVE species –by the firm and/or the individual professional staff. Bidding firms should provide examples of projects that met their established Performance Standards for all aspects of work including native design, installation, maintenance, and monitoring. References should also be sought and checked. While the authors of this Guide do not want to preclude firms who are just getting started in this business sector and have relevant expertise, it is recommended that qualified bidders have at least 5 years of experience in designing, restoring, and/or stewarding native landscape systems and/or ecological restorations in the Chicago Wilderness region. This helps ensure that the staff doing the work is knowledgeable of the native species desired, and the invasive and substitute species that may present challenges to the project.

It is suggested that contractor qualifications for the project include language such as in the examples provided below.

<u>Contractor Qualifications: EXAMPLE 1</u>

> *To qualify as a responsible bidder for the project, a Bidder must meet the minimum experience requirement specified herein. The work at all levels of involvement is to be performed by qualified individual(s) having the expertise necessary to perform the assigned tasks with the skill and precision appropriate to work in a highly sensitive environment.*
>
> *It is the intent to award a contract only to a bidder who furnishes satisfactory evidence that the have the requisite experience, ability, equipment, staffing, and sufficient capital and facilities to perform the work successfully and within the time specified in the contract documents.*
>
> *Prospective contractors must have a qualified botanist or ecologist on staff with accurate field identification skills regarding suitable hydrologic conditions for all specified plant species, including at least (2) years experience in native plant installation.*

Qualified contractors must demonstrate prior experience working in natural areas with sensitive resources, specifically native plant installation projects. Experience in the Chicago region is preferred and project experience shall be within the last five years.

Qualified contractors must have current capabilities and previous experience with successful plant protection measures and follow up management and monitoring activities.

Qualified contractors shall demonstrate that their company has not defaulted on any native plant installation performance standard with the past five (5) years.

Qualified contractors shall demonstrate sufficient access to local seed sources and plant nurseries that can successfully produce the diversity and quantity of native plant species required.

Contractor Qualifications: EXAMPLE 2

The construction manager or owner's representative will review and approve all contractor qualifications prior to contract award. To qualify as a responsible bidder for the project, a bidder must meet the minimum experience requirements specified herein.

Work associated with this project occurs in and near a sensitive environment that provides habitat for rare, threatened or endangered species. Work at all levels of involvement is to be performed by qualified individuals having the expertise necessary to perform the assigned tasks with the skill and precision appropriate to work in such a sensitive environment as solely determined by the owner's representative.

It is the intent of the owner to award a contract only to a bidder who furnishes satisfactory evidence that it has the requisite experience, ability, equipment, staffing and sufficient capital and facilities to perform the work successfully and within the time specified in the contract documents.

1) Qualified contractors will have the experience working in sensitive natural environments necessary to achieve performance standards related to any local, state, or federal permits.
2) Qualified contractors must demonstrate prior experience working in natural areas with sensitive resources, specifically plant installations within sensitive [riverine] ecosystems.
3) Qualified contractors must demonstrate their work has resulted in successful native seeding and plug establishment by submitting a list of projects of similar scope and complexity completed by the contractor that show their capabilities and experience. Include project names, addresses, size, and year completed, as well as, names and

contact information for references. Submitted projects shall reflect installation and stewardship responsibilities such as are described for this project.

4) Qualified contractors shall have at least five (5) years of experience in successful native seed and plant installation and stewardship within the Chicago Wilderness region.
5) Prospective contractors must have experienced practitioners on staff for this project as demonstrated by their involvement in other restoration/native landscaping projects of similar scope.
6) Qualified contactors must have current capabilities and previous experience with successful plant protection and erosion control measures and follow up management and monitoring activities.
7) Qualified contractors shall demonstrate that their company has not defaulted on any seeding/plant installation performance standards within the last five (5) years.
8) Qualified contractors shall demonstrate sufficient access to plant nurseries that can successfully produce the diversity and quantity of plant species required by providing a confirmed list of nurseries that demonstrate available inventory to meet project requirements.
9) The contractor shall maintain qualified, experienced full-time supervisor on the project site when planting or stewardship work is in progress.
10) Pesticide applicators must hold a state commercial license.
11) Contractor shall comply with all federal, state, and local ordinances and permits issue for the project.

For projects that will need controlled burning as an ecological management tool (see sections below), firm qualifications and insurance coverage should also be requested specific to this activity. There are three programs that are relevant to evaluating qualifications. First there is the National Wildfire Coordinating Group (NWCG) that has a standardized course curriculum that is used nationally by all federal agencies. Their courses include various aspects for both fighting wildfires and conducting controlled orprescribed burns. Many local agencies reference NWCG course numbers in theirqualification requirements. Second, the 2012 Illinois Prescribed Burning Act provides information and requirements for burn permits and prescriptions, and provides anIllinois Certified Burn Manager program. Thirdly, Chicago Wilderness has adapted NWCG training courses to offer a Chicago Wilderness Midwest Ecological Prescription Burn Crew Member training course that is more relevant to our local conditions.

Thus, it is recommended that when hiring a contractor to conduct controlled burns, the firm qualifications include providing a burn manager that has a valid Illinois Certified Prescribed Burn Manager Certificate issued by the IDNR. Some agencies also require completion of NWCG S290 and/or NWCG Rx90 training course for the burn manager or “burn boss.” Burn crew members should have successfully completed the MWCG S130 and S190 training courses or the Chicago Wilderness Midwest Ecological Prescription Burn Crew Member training course. In addition, each person must have a working knowledge and understanding of basic prescribed burn and fire suppression

principles. Any firm or contractor offering burn services must also have appropriate insurance coverage. Request documentation of their insurance coverage.

Specifications for Projects

Even for small projects, it is prudent to have project specifications for a contractor to follow so all details and expectations are clearly established and spelled out. Project specifications support the construction drawings, follow a standard format, provide specific direction for performing the work and typically include the following major sections especially for larger projects:

1) General
2) Products
3) Execution

Typically, General Specifications include bidder qualifications, quality assurance and submittal requirements, required inspections, direction regarding material substitutions, workmanship, product delivery constraints, storage and handling, site conditions, sequencing and scheduling, substantiating completion dates, protective measures, maintenance requirements and the landscape warranty if applicable. The Products section of the specification includes general and specific requirements for the materials to be used in the project such as plant material (species and size requirements), erosion control materials, mulch, and soil. Required performance standards and tests are also defined. The Execution section of specifications will usually include planting procedures, limitations that affect the installation period, stewardship expectations and schedule, and initial and final acceptance parameters.

The following text goes through the various elements that should be considered for inclusion within project specifications. It is important to note that in an actual specification or special provision document wording should be written in terms of "shall" rather than "may" or "should." It is written here to guide and make recommendations to the user of this Guide. For most projects, the specifications should address:

1) Project coordination/meetings
2) Contract duration
3) Resource protection
4) Temporary erosion control
5) Seeding/planting
6) Invasive species/weed control

Project Coordination/Meetings

Project meetings should be required at strategic project milestones to ensure good project coordination, satisfactory contractor performance, and appropriate interpretation of the specifications or any special provisions, several meetings should be required at strategic project milestones. The following meetings should be scheduled by the project sponsor. Summary notes of conclusions and action items should be distributed following each meeting.

1. Pre-construction on-site meeting prior to any practice installation or earthwork that may be a part of the project. Specifically, an onsite meeting is recommended to review site conditions, especially with regard to hydrology or moisture conditions, erosion, and soil conditions. This is to enable a common understanding and acceptance of the pre-project conditions before any seeding or planting commences.
2. Pre-plant installation meeting to review the contractor's schedule for sourcing the plant material, according to the anticipated project schedule. If live plant material (as opposed to seed) is to be installed, a meeting at the primary nursery (or nurseries) to conduct a preliminary inspection of the plant material and to discuss the plant delivery process and schedule may be part of this review. If it is a nursery you or the contractor are familiar or comfortable with, a trip to the nursery may not be necessary, especially for a smaller project. Photographs may be requested in lieu of a nursery visit. Inspection of all plant material upon arrival at the project site is essential to confirm the plant material meets specifications and your expectations. This inspection should be required in the specifications and is typically the responsibility of the contractor and/or owner. Documentation of such an inspection may be required by the owner.

Submittals

A variety of submittals may be required to be reviewed and approved by the project proponent or owner. These can include test results to show products (plants, seeds) meet quality specifications, photographs, or actual material samples. Possible submittal items to consider requiring include:

1) Test results demonstrating seed viability
2) Certification showing proper training for herbicide application or conducting controlled burns

3) Soil analysis based on a defined sampling schedule to indicate soil organic content or pH
4) Nursery sources for require plant material
5) Documentation of the attempts to locate specific plant material (species) when a species substitution is requested
6) Photographs of plant material in lieu of a nursery inspection
7) Stewardship (management) schedule, and documentation of actions completed
8) Documentation of completed actions for final acceptance

Contract Duration

It is strongly recommended that contracts for native landscaping and/or restoration work cover both the short-term activities of planting, seeding, and control of invasive species, as well as, a defined period of time to implement maintenance, management, and monitoring activities to ensure that the project is successful. For most native landscape installations, a three-year contract should be adequate to ensure initial establishment of native plants and control of most weeds. For ecological restorations, and compensatory mitigation projects required by regulatory agencies, a five-year period is common.

Any earthwork to be done as part of the project should be completed prior to planting or seeding work. At times on some projects this may not be possible, and the sequencing of earthwork and planting should be carefully reviewed and clearly understood by all parties. When the project includes the restoration or creation of wetland ecosystems, the project owner should specify that the contractor perform all the associated clearing, tree protection, erosion control, access, etc. work prior to April 1 to allow time for on-site observations of proposed hydrologic conditions prior to native planting.

Native plant installation should have firm time windows for planting and seeding established as part of the specifications. For example, native wetland planting should be completed between May 15 and July 15, whereas the planting window recommended for upland species is usually April 1 to June 15 or September 1 to October 1. Seeding of native upland areas may also be done as a dormant seeding after the first frost. The one, three-year, or five-year management and monitoring period always begins in the same calendar year that the landscaping/restoration areas are planted and permanently seeded. It is recommended that this period always be a minimum of 3 years for any seeded project. A one-year warranty is typical for a planted project whose goal is a native landscape aesthetic, however, if smaller plug material is used or there are extenuating circumstances that would not promote good plug growth, an extended warranty period may be advisable.

Careful sequencing should be specified to prevent plant installation activities from disturbing complete seeded or planted areas. The contractor may be required to provide and review the sequence schedule with the project sponsor/owner.

Weather provisions for seeding and planting should be spelled out, as in the following example: *Unless approved by the project sponsor a time extension will not be given due to weather unless the contractor submits a claim in writing with appropriate documentation that the weather resulted in unworkable conditions on the site for more than 30 days (cumulative) during the scheduled plant installation timeframe. Appropriate documentation for "Non Workable Days" for a wetland seeding for example, may include site photos showing limits and depths of inundation. Periods of drought should also be avoided for planting unless the contractor certifies that adequate irrigation can be provided.*

Labor

If the project is large enough that contractor labor crews will be used, a specification such as the following may be necessary: *A Project Foreman must be present each day the work is being performed. This individual will work closely with the project sponsor. He/she will be expected to keep the crew working in an efficient and safe manner, make sure the proper equipment is available and in good working order when needed by the crew, be able to answer any questions the crew might have, agree or disagree to the total hours of labor, equipment, and materials at the end of each working day. Each piece of equipment needs to be operated by a classified equipment operator.*

During all plant installation, the contractor shall have an onsite qualified botanist or ecologist that is dedicated to this project and available as required by the project. The dedicated botanist or ecologist must have accurate field identification skills regarding suitable soil moisture conditions for all specified plant species. Their qualifications, such as years of field experience in native plant installation should be defined and required as part of the project submittals.

Resource Protection

On most projects involving ecological restoration, there will be existing natural resources whose protection is of concern, such as valuable trees, remnant native communities, rare species, or regulated wetlands. Resource protection will often be less of a concern on native landscape installations such as naturalized detention basins or prairie buffers on an office campus. It is important to address protection of these resources in the specifications. Language should direct the contractor to use every possible precaution to prevent damage to existing conditions to remain such as vegetation, trees, animal habitat, and other natural features in or adjacent to the limits of the proposed improvements. Various areas of the property may have been delineated as regulatory wetlands and/or Waters of the United States. The contractor should be made liable to the landowner/project sponsor for all loss and damage suffered due to impact to the existing wetlands or other resources, other than the activities shown on any contract drawings and addressed in the specifications. Sample language is provided later in this section.

The specifications should make clear who is responsible for providing tree protection, barricades, fences or other barriers as necessary to protect existing conditions from damage during construction and planting operations. The specifications should require that the contractor provide immediate written notification of any damaged plants and resources to the landowner/project sponsor.

Specification language should require that any existing vegetation (trees, shrubs, plants, etc.) that are damaged, other than those that are proposed to be removed, must be replaced per the requirements of the project sponsor, landowner, and/or permitting agencies. These requirements should also be in the contract documents.

Unless otherwise indicated, all utilities and structures of any nature that may be affected by the work, whether below or above ground, shall be protected and maintained by the contractor and shall not be disturbed or damaged during the progress of the work. This must be spelled out clearly in the specifications and contract documents. An example of sample language follows: *Should the contractor disturb, discount, or damage any utility or any structure, all expenses arising from such disturbance or the replacement and/or repair thereof shall be borne by the contractor, including any expenses associated with a project delay. The contractor shall notify all potentially impacted utility companies prior to commencement of work and immediately notify project sponsor and landowner of any potential conflicts.*

Construction Requirements

Existing trees or other vegetation, particularly certain species or those of a specific size, are significant resources and may warrant special protection measures. If appropriate within the scope of the project, protection measures should be addressed as specifically as possible within the specifications. The following can be used as sample specification language.

> *All plant material designated to be saved shall be protected prior to the beginning of clearing and shall remain protected during subsequent work. Parking or maneuvering of machinery, stockpiling of materials, or any other use will not be allowed upon unpaved areas within 10 feet of the root zone of trees or plants designated to be protected, unless other approved tree protection techniques are utilized. If requested by the contractor, the project sponsor/landowner will stake or otherwise mark the protection limits.*

The contractor shall manually erect temporary fencing where directed by the owner/project sponsor, along access routes and active construction areas to define contractor project access limitations, to protect existing trees and other sensitive vegetation and/or habitats, and to protect and warn the general public. The temporary fence shall be similar to plastic lathe snow fence, and shall be a minimum of 4 feet high with 6 foot steel "T" posts placed at a maximum of 15 feet apart. This boundary will define the project limit for TREE PROTECTION along forested areas of significant ecological value and cannot be crossed. Unauthorized access by the contractor beyond this fencing shall result in an amount of $500.00 per incident and will be deducted from any monies due the contractor. In addition, any tree damages beyond this fencing, protected or otherwise, shall be deemed a total loss. The project sponsor/landowner will have a Tree Valuation to be performed by a Certified Arborist to determine the value of the tree and that tree shall be considered a total loss. The valuation of each damaged tree shall also be deducted from any monies due the contractor.

If requested by the owner, the contractor shall provide 2 inch x 6 inch x 8 feet boards banded continuously around each trunk to prevent scarring of any trees located within 15 feet of any heavy equipment work areas. For multi-stem trees, saplings, and shrubs to be protected within the area of construction, temporary fencing may be used for trunk protection.

Soil Compaction

Where sensitive areas exist, such as native trees, prairie, or wetland vegetation, avoidance or reduction of soil compaction in critical root zones may be necessary. The use of untreated wooden or composite mats should be specified in these situations if any heavy equipment will be used. The goal is to use matting to spread the weight load from the equipment over a larger area and reduce soil compaction and rutting.

If appropriate, the owner/sponsor may require that the contractor provide untreated wooden mats comprised of a minimum dimension of 6 inch x 6 inch timbers x 12 feet long that are bound together by cable or other acceptable means in variable lengths to be placed as Ground/Root Protection where indicated on plans or where directed by the project sponsor/landowner. Composite mats are available that are not as thick, but which interlock and can also be used in this situation. The goal is to use matting to spread the load from heavy equipment over a larger area and reduce or eliminate compaction of the soil in the root zone. Suppliers of timber or composite matting can provide data

on the load reduction capacity of their products. Low ground pressure equipment should also be used wherever possible, and can be specified in contract documents.

Tree Pruning

Trees designated for protection during construction or planting activities, should have any branches that are likely to be damaged by equipment or personnel should be pruned to avoid breakage and disease potential. Any branches damaged during construction should be pruned as well. Sample language to ensure this work is done as part of the contract follows:

> *All pruning shall be done according to the National Arborist Association's Pruning Standards for Shade Trees Class II – Standard Pruning Specifications. Pruning for safety purposes shall be shown on the plans or as directed by the project sponsor/landowner. Branches on existing plant material to remain that need to be removed for safety or equipment clearance shall be pruned prior to or during the clearing operation. Breaking off branches of plant material to remain during clearing or construction operations will not be allowed.*

Tree and Shrub Planting

Native tree and shrub planting within native landscaping and restoration projects should also have relevant specifications and performance standards. The following are suggested for inclusion in tree and shrub planting performance standards and material specifications.

All shrubs or tree species shall be container grown or balled and & burlapped (B&B). All plant materials shall exhibit healthy, vigorous growth. All plant materials shall conform to the following standard: ANSI Z60.1, current edition (American Association of Nurserymen, 1250 I Street, N.W., Suite 500, Washington, DC 20005).

Mulch for all tree, shrub, and vine plantings shall be double processed shredded bark and wood chips, free of other foreign material. Mulch shall be dark brown in color.

Stake, flag or otherwise demarcate the location of all trees, shrubs, and vines for Owner approval prior to commencement of planting work.

Planting of trees, shrubs, and vines shall preferentially be completed as soon as the soil is free of frost and in a workable condition but no later than June 1st.

Trees, shrubs, and vines shall be transported and stored in such a manner as to insure adequate protection against wind damage, desiccation, and other physical damage.

If planting is delayed more than four hours after delivery, set plants in shade protected from weather and mechanical damage, mulch root balls, and keep plants moist and cool.

Excavate plant pits with hand tools. Plant pits shall be round with vertical sides and flat bottoms. Plants pits shall be twice the diameter of each plant's root ball.

Loosen or scarify the bottom of plant pits to a depth of 4 inches.

When conditions detrimental to plant growth are encountered during excavation such as rubble fill, adverse drainage, or other obstructions, notify the Owner or project sponsor immediately in writing before planting.

Handle trees, shrubs, and vines in accordance with best horticultural practices. Lift B&B materials from the bottom of root ball only.

When excavating plant pits, ensure root collar will be 1" above finished grade after planting.

Plant all trees, shrubs, and vines straight and true, plumb to the ground surface.

Remove rope, wire basket, plastic wrap, and any other material from the root ball, lower trunk or stems that may girdle or otherwise adversely impact plant growth.

Remove container from container-grown planting stock prior to placement in pit. If container-grown stock is root bound, score sides and bottom of root mass.

Backfill plant pit with excavated material to match surrounding finished grade.

All trees, shrubs, and vines shall be mulched immediately after planting to a uniform depth of 3". Mulch shall be kept out of the crown of plant materials and off buildings, sidewalks, light standards, adjacent seeding/planting areas, and other structures. Do not mound mulch around the base of plant materials. Mulch must cover all of root ball.

All trees, shrubs, and vines shall be watered by the Contractor immediately following planting. The Contractor shall be responsible for continued watering of all trees, shrubs, and vines as needed during guarantee period.

Repair of Damaged Areas

It is important that project specifications include language that addresses the repair requirements of all areas that may be damaged by construction/planting activity.

Depending on the type of project, this may include impacts to natural areas, turf areas, and/or hardscape. Sample contract language follows:

> *Any damaged areas caused by the contractor shall be restored to their original condition without additional compensation.*
>
> *or*
>
> *Any onsite areas disturbed by contractor activities shall be restored per the direction of the project sponsor. Restoration will be performed to the satisfaction of project sponsor at no additional cost to the project sponsor. Any restoration required for offsite areas (local roads, R.O.W.s, etc.) as a result of contractor negligence, will also be performed at the request and satisfaction of project sponsor , without compensation from the project sponsor. Final payment will not be released until all areas disturbed by contractor have been restored to the satisfaction of the project sponsor.*

Temporary Erosion Control

If the project area has any slope, appropriate erosion control is typically necessary. For simple native landscaping projects this is often over looked and can result in the native seed being washed away during the first substantial rainfall. It can also result in substantial erosion gulleys developing that require re-grading and re-planting. To avoid conflicts with the contractor after installation is complete, the contract documents should be very clear on what erosion and seed/plant protection measures are expected, where they are to be applied, and who is responsible for their installation and maintenance during the construction and warranty period.

In many cases, a short-term, completely biodegradable erosion control blanket such as S75BN by North American Green, or approved equal, may need to be required in all newly vegetated areas. The S75BN temporary erosion control blanket is intended for shallower slopes generally located outside of any low flow area of a stream or detention area. Other heavier erosion control blankets may be needed in other more erodible situations such as stepper slopes or areas that receive higher water flow velocities. However, consideration should be given when writing the specifications that a dense blanket may hold the soil better, but prevent light penetration necessary for seed germination. Installation of any erosion control blanket should be required the same day or within 24 hours of specified seed installation. Secure all blankets with non-metal biodegradable staples/stakes in accordance with manufacture's recommendations. A design consultant or contractor can help identify where soil erosion control measures are necessary and the type that should be utilized. The manufacturer of erosion control products can also be a resource if further information is needed.

Weed Control

In many restorations or native landscaping projects, control of pre-existing weeds is absolutely critical to prepare the site for seeding or plant installation to ensure a successful ecological restoration project. This weed control work should be specified up front, so that there is agreement about the condition of the site at the time of seeding or planting. Weed control work may consist of mechanical and/or chemical control activities to kill all weeds within the restoration area prior to seed or plant installation. For most instances the specifications should require a ninety percent (90%) kill of these species prior to any planting. For difficult to control invasive species and/or in fallow field situations with an array of default weeds, a secondary application may be necessary to achieve full control. The specifications should clearly list the species where this performance standard applies. Consideration should also be given to the herbicide used if chemical control is chosen, in terms of where it is to be applied and the residual time of the herbicide. Allow enough time between the weed control activities and seeding or planting so that the residual chemicals do not adversely affect the planted or seeded material.

Seed Mixes

Native seed mixes are supplied in pounds of Pure Live Seed (PLS) for native grass and most forb species. It is also important to specify that native seed will be of a local genotype as typically defined as sourced from a radius of 100-200 miles from the project site. The radius depends on the availability of the desired species, and the objectives of the project. A smaller radius is often specified when the project is restoring a remnant native community that is of a higher pre-existing ecological quality. A larger radius is generally adequate for native landscaping projects where some form of ecological restoration is not the goal of the project and the site is not adjacent to an existing natural areas or conservation site. There is always a balance between the desired genetic purity of the local restoration versus what the contractor/nursery can reasonably supply. If a smaller radius is deemed appropriate, sometimes it is necessary to allow an extra year for a nursery to contract grow certain species from local seed sources. Seed from multiple vendors may also be required to enhance genetic diversity and seed viability.

It should be noted that some species that may not be available as Pure Live Seed (PLS). These can be seeded into a project separately with the chaff. For rarer species and species with less production and demand, nurseries may not go to the expense to have the seed cleaned and tested.

Seeding equipment is often done with a hydraulic seeder, broadcast seeder, or a rangeland type drill (no-till). Consideration should be given to whether the specifications require the seed to be sown using a particular type of seeder or in smaller projects by hand broadcasting. Some seeding methods (drill) cause the plants to appear in rows, though this affect can be reduced by criss-cross seeding. Some enable excellent seed-soil contact for germination, but this may preclude good germination by other species that have a light requirement for germination. In a more

diverse seeding effort, it is often best to deploy multiple seeding techniques for maximum success across all species germination requirements. The goal is to be clear up front, so there are no surprises after seeding. Language in the performance standards can drive the method of choice. The project sponsor/owner in most cases should not dictate which method should be used but rather the final outcome that is required. In the sections below, much information is provided regarding specific methods to help you understand what may be most effective and to judge the contractor's knowledge and experience. Native seed suppliers are often helpful in clarifying the decisions.

Seedbed Preparation

Specifying the appropriate seedbed preparation is necessary for bare earth seeding. The contract documents should specify that the contractor start with a clean bed prior to seedbed preparation activities and prepare the seedbed in such a way as to eliminate large clumps. Sample language below provides specification requirements for this.

> *The contractor shall remove stones, roots, and sticks prior to seedbed preparation and with a disk or unique rake (harrow) reduce clod size to a maximum diameter of 2-inches and eliminate rivulets, gullies, crusting, and caking. The disk shall be in good condition with sound, unbroken blades and weighted as necessary to achieve a minimum 3-inch tillage depth. Following these seedbed preparation activities, the ground surface shall have minimum compaction, be smooth and level, and be free of debris to promote good seed-soil contact.*

The documents should stipulate that seedbed preparation not inadvertently result in soil compaction from work during wet soil conditions or from too many repeated passes with equipment. A balance must be struck between overworking the soil, and achieving specifications.

Seeding Conditions

Specifications should also require the contractor to examine the grade, verify the elevations and water levels, observe the conditions under which work is to be performed, and notify the project local sponsor and/or engineer of unsatisfactory conditions. Specification language usually states that *"Proceeding with the work constitutes acceptance of existing conditions, including current water levels and soil condition."* This last point should be made clear to the contractor and documented in order to avoid disputes later.

Seeding Methods

Specifications must include the requirement that no seed shall be sown during high winds, rain events, or when the ground is not in a proper condition for seeding. Specifications should also indicate that seed should not be sown until the purity test has been completed for the seeds to be used, and shows that the seed meets the

noxious weed seed content requirements. Some specifications include a maximum number of days between PLS seed testing and sowing.

If site conditions are too wet to physically access any native seeding areas with a tractor and native seeding equipment without rutting and/or otherwise altering the proposed seeding and planting surface, an ATV or similar type low ground pressure equipment equipped with a broadcast seeder may be a viable seed installation alternative. In any situation, the seeding equipment should not rut and/or otherwise alter the proposed seeding and planting surface. For more mesic prairie seeding areas, seed will typically be broadcast on the soil surface. Following seeding, the surface should be raked to ensure better seed soil contact.

Species Substitutions

Prior to installation, the project sponsor/owner should review any species substitutions and reserve the right to deny use of any species if deemed inappropriate for the site.

Notification & Documentation

It should be specified that the contractor shall notify the project sponsor/owner at least two working days prior to seed installation and indicate the seed installation method to be used. After completion of seeding, contractor shall provide the project sponsor/owner with copies of all seed receipts and labels, notated with the date of seed installation, seed origin, percent PLS, and conditions under which the seeding was performed.

Planting Plugs

Native wetland vegetation is often planted with plugs or small plants due to water levels that make seeding less effective. These plantings are appropriate in wetland restorations, aquascapes, and stormwater best management practices such as detention basins, bioswales, and rain gardens.

Due to the amount of wetland planting work done for regulatory purposes, there have been many specifications developed for wetland plug planting. This work typically consists of furnishing, transporting, and installing container-grown plants for aquatic, deep emergent, shallow emergent, and sedge meadow areas. Planting areas shown on plans are typically approximate limits for each planting zone based on anticipated normal water levels and soil moisture conditions, bathymetric survey information, and

field observations. Plugs are also commonly used in non-wetland native plantings for species that are difficult to establish from seed, or if desired to achieve growth and cover objectives.

The container-grown plants should have a minimum shoot height of 12 inches at the time of planting. It is important to specify the minimum pot dimensions for container-grown plugs to be at least 2 3/8 inches wide and 3 3/4 inches deep. Specify that soil moisture appropriate to the plant species shall be maintained for all container-grown plants until installation. All container-grown plant material should be inoculated with mycorrhizal fungi and container-grown plants should exhibit root growth sufficient to hold all soil intact when removed from container. It is the root growth and condition that is most important for a successful planting.

Some plant material may be provided as dormant root material (*i.e.*, tubers, rhizomes, bulbs) or bare root material, if specified or desired.

Contract document language should specify if the contractor or project sponsor/owner is responsible for manually irrigating plantings and/or artificially raise the water level to provide suitable hydrologic conditions if water levels are lower than anticipated or historically observed. At the same time, plant installation should be prohibited when water levels are greater than 3" above the anticipated average water levels unless specifically approved by the project sponsor/owner.

Performance Standards

Performance standards are established for a project so that the expectations are clearly defined. It is important that all parties know what success looks like and can establish criteria to define success prior to project implementation. This avoids disputes after the project is complete because different parties made differing assumptions. It is also imperative that who makes that final determination of success is clearly established up front. In some cases, it is simply the client who will determine if the work of the contractor has met established performance standards. But if there are multiple contractors or consultants involved, if there is a third-party conservation easement, if the property owner is not the same as the client, or if there is a regulatory agency involved this becomes more complicated, and must be clearly spelled out in advance. It must also be understood that these guidelines are not intended to apply to regulatory situations where the performance standards are established as conditions of a permit.

Performance standards must also be defined by the project purpose and objectives. If the project purpose is to have an aesthetically pleasing native landscaped garden area, then the performance standards would be quite different than if the project purpose is for ecological restoration of a native prairie or woodland remnant. Some sample performance standards are offered below for different project purposes.

These should be used as a guideline, and in recognition of possible multiple project purposes.

Performance standards may also be qualitative or quantitative depending on the individual circumstance. The goal should be to reduce subjectivity to avoid differences of opinion when determining if a project has been successful or not. Monitoring will be necessary to collect the data that determines if various performance standards have been met. Monitoring can also be used to inform ongoing management. Adaptive management is the concept where monitoring results drive the management decisions in a feedback loop so that the management techniques drive the project to success. If a particular management or maintenance activity is not having the desired effect, as shown by monitoring results, then another approach can be applied. This type of monitoring, whether qualitative or quantitative, should be included in all projects. Monitoring and management guidelines and specifics are covered in their own section of this document. But it must be emphasized that the performance standards must drive the monitoring conducted, and the monitoring results must drive the management and maintenance applied.

General Performance Standards

Planting and seeding work should generally be paid for at an agreed upon contract unit price and should explicitly include all labor, equipment, and materials necessary to complete the work as specified. Contract documents should specify performance standards and the management and monitoring period. Generally, in native seeding and planting projects a 3-5 year management and monitoring period is recommended. If performance standards are not achieved, the contractor shall be responsible for rectifying any deficiencies through additional site management activities, which may include re-planting and re-seeding, at the sole expense of the contractor, as indicated in contract documents.

Suggested Planting/Seeding Performance Criteria

The intent of the performance criteria is to ensure the establishment of native landscapes that are functional, aesthetic, and relatively weed free. In all areas, native landscapes and restorations shall be maintained with a permanent vegetation cover at all times to minimize erosion. If erosion, rills or gullies are forming, remedial measures should be implemented immediately. If erosion is detected, management practices such as spot dressing/repair, light mulching, and over-seeding or replanting shall be implemented immediately.

The success of a natural landscaping or restoration project should be formally evaluated by the following vegetation performance standards monitored over time.

> *1st Year: By the end of the first full growing season, the planted areas should have 90 percent vegetation cover. At least 90 percent of the plugs, root stock, and tubers, and 50 percent of the species planted as seed should be present and alive.*

No upland area (i.e., non-wetland) greater than 1 square feet shall be devoid of vegetation.

2nd Year: During the second growing season, a minimum of 60 percent of the permanent species planted in seed form should be evident. Ninety percent or more of species planted as plugs, root stock, and tubers shall have persisted into the second season. If this level of vegetation establishment fails to occur, a determination must be made as to why, and a remedial action plan shall be necessary. Remediation shall include overseeding and/or plugging of appropriate species. Also, undesirable, invasive plant species shall not be prevalent in the naturally landscaped or restored areas. More specifically, no invasive species, including by not limited to those listed in Table 1, shall be among the five most dominant plant species in the overall vegetative cover in any planting unit.

3rd Year: At the end of the third full growing season, a minimum of 75 percent of the seeded permanent species and 90 percent or more of species planted as plugs, root stock, and tubers are expected to be established. Native perennial species that volunteer on the site, excluding undesirable invasive species, may also be counted in determining the preceding criteria. Commonly, if the planted species are not evident by the end of the third season, the likelihood of subsequent appearance is reduced. Acceptable species defined as native to the region and not invasive (as listed above and in the Native Plant Guide for Streams and Stormwater Facilities in Northeastern Illinois), shall provide at least 90 percent of the relative aerial coverage. Also, no invasive species, including but not limited to the species listed in Table 1, shall be among the five most dominant plant species in the overall vegetative cover in any planting unit. If the identified level of species development fails to occur, a determination must be made as to why, and a remedial action plan must be prepared and submitted for approval. The approved remedial plan must be implemented and continued monitoring will be required beyond the third growing season until these Performance Criteria are met.

Table 1. Invasive species that should be controlled and not be a dominant species in any native landscape or ecological restoration, if present at all.

Arrow-wood viburnum (*Viburnum recognitum*)
Autumn olive (*Eleagnus umbellatus*)
Bird's Foot Trefoil (*Lotus corniculatus*)
Black locust (*Robinia pseudoacacia*)
Box elder (*Acer negundo)*
Burdock (*Arctium minus*)
Canada goldenrod (*Solidago canadensis*)
Canada thistle (*Cirsium arvensis***)**
Chinese yam (*Discorea oppositifolia*)
Common buckthorn (*Rhamnus cathartica*)
Common reed grass (*Phragmites australis*)
Crown vetch (*Coronilla varia*)
Eurasian honeysuckles (*Lonicera* spp)
Garlic mustard (*Alliaria petiolata*)
Giant hogweed (*Heracleum mantegassianum*)
Glossy buckthorn (*Rhamnus frangula*)
Japanese barberry (*Berberis thunbergii*)
Japanese hops (*Humulus japonicas*)
Japanese knotweed (*Fallopia japonica*, aka *Polygonum cuspidatum*)
Leafy spurge (*Euphorbia esula*)
Lesser celandine (*Ranunculus ficaria*)
Moneywort (*Lysimachia nummularia*)
Multiflora rose (*Rosa multiflora*)
Narrow-leaved & hybrid cattail (*Typha angustifolia*, *T.* X *glauca*)
Non-native thistles (*Cirsium spp., Carduus spp.*)
Oriental bittersweet (*Celastrus orbiculatus*)
Purple loosestrife (*Lythrum salicaria*)
Ragweed (*Ambrosia trifida, A. artemisiifolia*)
Reed canary grass (*Phalaris arundinacea)*
Sandbar willow (*Salix interior, aka S. exigua*)
Spotted knapweed (*Centaurea maculosa*)
Tall goldenrod (*Solidago altissima*)
Teasel (*Dipsacus spp.)*
Teasel (*Dipsacus sylvestris, D. laciniatum*)
White and yellow sweet clover (*Melilotus alba, M. officinalis*)
Wild parsnip (*Pastinaca sativa*)

Note that new invasive species are constantly becoming established in the Chicago Wilderness region. In addition, other species may be particularly problematic in your part of the region. The Northeastern Illinois Invasive Plant Partnership (NIIPP) (www.niipp.net) and the Midwest Invasive Plant Network (MIPN) (www.mipn.org) are great resources for up to date invasive species information including control methods and latest new invaders.

Tree and Shrub Performance Standards

The following are suggested as performance standards for any tree and shrub planting done as part of any native landscaping or restoration project.

The work shall be accepted after planting and mulching, and after the Contractor has completed all required clean up, removal, and repair as described in contract documents.

The Contractor shall guarantee at no additional cost to the Owner that all tree and shrub planting work meets the following performance criterion twelve months after provisional acceptance: 100% of all plant materials are alive and healthy. Determination of viability and health of plants at the end of the guarantee period shall be the sole judgment of the project sponsor or Owner.

Any trees or shrubs that do not meet the performance criterion stated above shall be replaced by the Contractor at no additional cost. Replacement plantings will be subject to an additional twelve month guarantee period as described above.

Aesthetic Native Landscape Performance Standards

While native landscape projects that do not contain an ecological restoration component clearly differ in project purpose, many of the survival and cover standards provided above can and should still be applied. However, in settings where native plantings and seeding are being used in more formal garden-like settings some different standards may be appropriate. Native landscapes are often modeled after presettlement native ecosystems such as prairies, woodlands, and wetlands, but they are not necessarily attempts to restore historic conditions. Although native landscapes can appear more random than their more formal traditional landscape counterparts, native landscapes must be thoughtfully planned and designed to provide the functions and benefits for which they are intended. Native landscapes can appear “messy” or “weedy” to some people. To help overcome this perception, it is important to include elements that appear intentional and cared for by people. This can include mowed edges along pathways or lawn, enhancement areas with massings of species with showy floral displays or other ornamental characteristics, clusters of tree or shrub plantings that ecologically and visually compliment herbaceous vegetation, and similar ideas. It is also import to select species that will thrive in the conditions which they are being planted. Just because a species occurs, possibly even dominates, a natural community does not mean it will thrive in a man-made environment. Lastly, providing timely and effective maintenance –

including annual burns, trash removal, pruning, and replanting struggling or failed areas – will help the public to understand that the native landscape is intentional and being cared for, rather than the result of neglect or lack of funding. Thus, it may be prudent to establish some basic aesthetic goals and maintenance expectations up front, similar to the establishment of other performance criteria.

Ecological Restoration Performance Standards

For ecological restoration areas, where the goal is to restore or re-create a native plant community, more specific or rigorous performance standards may be needed. In each restoration situation, ecological performance criteria should be specified in contract documents. These may include criteria for native species richness (number of native species present), number of native perennials present, minimum vegetative cover standards, and floristic quality criteria. Often these various criteria are used in combination, and may also include the 3-5 year performance criteria provided above. For example, for wetland restorations done as part of permitted mitigation, the following is often included in addition to the standards listed above.

> *At the end of the three-year period (or the end of the five-year period if applicable), the following minimum floristic diversity standards shall be achieved for each of the plant communities: 15 native perennial species shall be present in the shallow emergent and deep emergent zones in aggregate; 20 native perennial species shall be present in the wet meadow zone. In addition, the wetland communities in aggregate shall achieve a minimum native FQI of 20.0 and a minimum Mean C value of 3.5.*

The project's ecological goals should be used to specify performance standards in terms of native species richness (number of native species present), number of native perennials present, minimum native vegetative cover standards, invasive species maximum cover and frequency, floristic quality index, mean coefficient of conservatism, or other relevant criteria.

Performance standards in ecological restoration work may also be needed for controlled burns and herbicide work. Though it should be noted that if burning and herbiciding are used effectively, their main purpose is to contribute to meeting the vegetation performance standards described above. However, some specifics may be needed along the way to ensure services are performed adequately to lead to the vegetative results desired. Burns can usually be characterized as percent coverage – *i.e.* what percent of the landscape within the burn unit is now blackened. If only 25% of a given burn area carried a fire enough to remove the vegetation and leave a blackened landscape, it may explain substandard performance in meeting vegetation standards. It must be noted, however, that different fuels types have a big effect on how much burn coverage can be expected. Graminoid fuels are generally going to result in more complete burns than those that rely upon leaf litter, for example. Set realistic goals and make sure the contractor understands those goals so they select appropriate weather conditions. The prescription burn plan that should be prepared for every burn, should also lay out ecological objectives for the burn. If these objectives are not met, then the burn is not successful and should not be considered to have met performance standards.

Water Quality Best Management Practice Performance Standards

Some native landscape features may also be constructed as best management practices (BMP) intended to provide water quality benefits. In such cases, some performance standards regarding actual water quality parameters may be warranted. Often these practices are implemented but no follow-up monitoring is conducted to confirm their effectiveness. The details of such a monitoring program is beyond the scope of this Guide, but some basic information is offered for consideration.

Chemical and physical water quality monitoring includes the collection of water quality samples that are analyzed for various parameters based on the type of BMP and its water quality objectives. Some of the parameters that may be considered are:

- Temperature
- pH
- Dissolved oxygen (DO)
- Conductivity
- Total suspended solids (TSS)
- Metals including cadmium, chromium, copper, iron, lead, manganese, mercury, silver, and zinc
- Nitrogen including nitrite, nitrate, and total nitrogen
- Phosphorus including dissolved phosphorus and total phosphorus
- Bacteria
- Chlorides

Temperature

Water temperatures fluctuate with daily air temperatures, as well as, with seasonal changes, *i.e.*, water temperatures are higher in summer and cooler in spring and fall. Maximum water temperatures in local streams over 20°C may preclude most fish from using these streams for habitat.

pH

Normal pH (a measure of hydrogen ions in the water) values in streams and ponds should range from 6.5 to 8.5, good conditions for aquatic life.

Dissolved Oxygen

Algae and aquatic plants in a pond or creek can elevate dissolved oxygen (DO) concentrations during the day (due to photosynthesis) and lower DO concentrations at night (due to respiration). Low DO conditions typically exist in mid to late summer when air and water temperatures are high and water levels are low. DO concentrations below 5.0 mg/L can stress many fish species, and concentrations below 1.0 mg/L (hypoxic

conditions) can be detrimental to aquatic life. It should be noted that DO concentrations will vary by season and depth within the water column.

Conductivity

Specific conductivity indirectly measures the concentration of chemical ions or dissolved salts in the water, and may be an indicator of salt as a pollutant. The more chemical ions or dissolved salts a body of water contains, the higher the conductivity will be. Conductivity levels of 200-1,000 µS/cm are indicative of normal background levels. Conductivity outside of this range may not be suitable for certain species of fish or bugs. High conductivity (1000 to 10,000 µS/cm) is an indicator of saline conditions. High chloride concentrations following salt applications for snow melting in winter can lead to high conductivity readings, as can the leaching of effluent from a sanitary sewer line into a stream. Low water levels tend to increase concentrations of ions in the water column, while rain events tended to temporarily flush ions out of the stream system.

Total Suspended Solids (TSS)

Total suspended solids (TSS) include all particles suspended in water which will not pass through a filter. Suspended solids are present in effluent from wastewater treatment plants and many types of industrial wastewater. There are also nonpoint sources of suspended solids, such as soil erosion from agricultural and construction sites. As levels of TSS increase, a water body begins to lose its ability to support a diversity of aquatic life. Suspended solids absorb heat from sunlight, which increases water temperature and subsequently decreases levels of dissolved oxygen (warmer water holds less oxygen than cooler water). Photosynthesis also decreases, since less light penetrates the water. As less oxygen is produced by plants and algae, there is a further drop in dissolved oxygen levels. TSS can also destroy fish habitat because suspended solids settle to the bottom and can eventually blanket the river bed or pond bottom. Suspended solids can smother the eggs of fish and aquatic insects, and can suffocate newly-hatched insect larvae. Suspended solids can also harm fish directly by clogging gills, reducing growth rates, and lowering resistance to disease. Changes to the aquatic environment may result in a diminished food sources, and increased difficulties in finding food. Natural movements and migrations of aquatic populations may be disrupted. Removal of suspended solids is often one parameter where native planted best management practices can be very effective. Filter strips, rain gardens, bioswales, and other features that deploy native vegetation can help filter out suspended solids by slowing water flow through thick vegetation, physically trapping sediments, and allowing some infiltration into soil penetrated by deep roots.

Nutrients

Nitrogen can be found in several different forms in terrestrial and aquatic ecosystems. These forms of nitrogen include ammonia (NH3), nitrates (NO3), and nitrites (NO2). Nitrogen is an essential plant nutrient, but in excess amounts it can cause significant water quality problems. Together with phosphorus, nitrogen in excess amounts can accelerate eutrophication, causing dramatic increases in aquatic plant growth (for example algae blooms) and changes in the types of plants and animals that live in stream and lakes. The increase in aquatic plant growth, in turn, affects dissolved oxygen (DO), temperature, and other water quality indicators. Excess ammonia (NH3), nitrates (NO3),

and nitrites (NO_2) can cause hypoxia (low levels of dissolved oxygen) and can become toxic to warm-blooded animals at high concentrations under certain conditions. Nitrate levels above 10 mg/L are above drinking water guidelines. The natural level of ammonia or nitrate in surface water is typically low (less than 1 mg/L). Sources of nitrates include wastewater treatment plants, runoff from fertilized lawns and cropland, failing on-site septic systems, runoff from animal manure storage areas, and industrial discharges that contain corrosion inhibitors. Similar to suspended solids, vegetation best management practices can be effective in removing nitrogen by plant uptake if not at excessive levels.

Similar to nitrogen, phosphorus is an essential nutrient for the plants and animals that make up the aquatic food web. Since phosphorus is the nutrient in short supply (limiting nutrient) in most fresh waters, even a modest increase in phosphorus can, under the right conditions, set off a whole chain of undesirable events in a stream or pond including accelerated plant growth, algae blooms, low dissolved oxygen, and the death of certain fish, invertebrates, and other aquatic animals. Pure, "elemental" phosphorus (P) is rarely found in nature. Typically, phosphorus exists as part of a phosphate molecule (PO_4). Phosphorus in aquatic systems occurs as organic phosphate and inorganic phosphate. Organic phosphate consists of a phosphate molecule associated with a carbon-based molecule, as in plant or animal tissue. Phosphate that is not associated with organic material is inorganic. Inorganic phosphorus is the form required by plants. Animals can use either organic or inorganic phosphate. Both organic and inorganic phosphorus can either be dissolved in the water or suspended (attached to particles in the water column). There are many sources of phosphorus, both natural and human. These include soil and rocks, wastewater treatment plants, runoff from fertilized lawns and cropland, failing septic systems, runoff from animal manure storage areas, disturbed land areas, drained wetlands, water treatment, and commercial cleaning preparations. Vegetation best management practices can be used to filter and remove phosphate in runoff before it enters a water body. Thus, basic total phosphorus testing may be a technique to monitor the effective of such a BMP.

Chlorides

Chloride salts are essential for aquatic health. However, when high levels of chloride contaminate fresh water streams and lakes, it becomes toxic to fish and other aquatic life forms. Chlorides may enter surface water from rocks, agricultural runoff, industrial wastewater, wastewater treatment plant effluents and, most significantly, wintertime road salts. The Illinois water quality standard for chloride is 500 mg/L. Many area water bodies exceed this standard in first flush events after winter deicing. However, because chloride exists as an ion in solution, BMPs are not known to be effective in removing or reducing chloride concentrations.

Monitoring and Management Guidelines

Management

Years of experience and research have demonstrated that certain basic management activities are necessary and effective for the health of natural communities and the conservation of biodiversity of the region. While continuing research is important to

improve management techniques, ongoing management is essential for all of our natural communities and native landscapes. Applying adaptive management in a context of monitoring is the best way to improve on existing techniques and improve project success.

Guidelines cannot necessarily identify the specific practices or techniques to be applied at any given site. No single best method or combination of methods can be applied across the region for all situations. Management plans should be developed for each site using management practices adapted to site conditions and appropriate to the goals for the site. However, guidelines can point out factors and concerns that are helpful in thinking through site-specific management plans and the use of various practices throughout our region.

For most native landscaping projects, contractors installing native plants should perform maintenance, management, and monitoring for a minimum of three years, or until all performance criteria are met. Maintenance activities should be based, in part, on problems identified in the annual monitoring effort. Although specific maintenance and management needs will be determined in the field, standard management protocols should generally include the following measures.

For the 1st year after planting/seeding, if unusually dry conditions persist short-term irrigation shall be done to prevent desiccation. Irrigation generally will not be necessary, however, if planting is done in the recommended seasons of late fall through spring.

A maintenance regime must begin during the first growing season in order to prevent the establishment of invasive species/weeds and their adverse effects on the desired native seedlings. Control of undesirable plant species (as listed under “Performance Criteria”), shall be done in a timely manner. Methods of control include hand pulling, mowing, spot herbicide application, or a combination of these methods. The appropriateness of a particular control method depends on the plant species present and their density or prevalence.

Mowing is a recommended management option to control undesirable upland species, especially if they persist over a large area. During the establishment year, mow weeds after they have reached a 12 inch height. Mow 2–3 times, generally on 30 day intervals from the date of seeding. Mow to a height of 6 to 8 inches using a rotary mower, or remove the clippings so as not to smother the seedlings. This will slow the weeds but won't harm the native plants. Mowing in native landscapes or restorations should only be used as a management technique where it will not result in rutting of the soil and disturbance of the planting. Spot mowing can also be used to control specific patches of weeds/invasive species where appropriate to reduce seed set.

Weed growth in the second season may be treated by targeted herbiciding, hand pulling, or mowing. The appropriate protocol should be determined in the field. If sufficient fuel is present, a controlled burn may be scheduled by the end of the second growing season.

By the third growing season, native grasses, sedges, and forbs should be relatively well established and weed growth should be declining significantly. Control measures such as weeding, mowing, or herbiciding should be continued on an as-needed basis. It is anticipated that controlled burn management will serve as the primary form of plant community management from the 3rd year onward. Controlled burns should be conducted only after receipt of all required permits and by trained individuals or contractors.

The specific approach may be somewhat different for larger scale ecological restoration projects. Guidelines can help in selecting management techniques to eliminate an ecological stress from a native community or landscape. Some sites with invasive brush can be managed with prescribed fire alone, while others may require hand clearing, and still others will warrant mechanical clearing. The goal of all of these treatments is to maintain the site using only prescribed fire. But due to different densities of brush and other site conditions, different restoration techniques are needed to get to this stage. The effectiveness of the restoration technique can be measured in more than one way. First, one can check the reduction of the invasive brush. Second, one can see the intensity and coverage of the controlled burn. A third, longer-term measure would be the recovery of the natural community. In most cases, land managers are trying to correct damage done from as many as 200 years of neglect. Restoration is a process that requires time, and some sites may take several years before beginning to show significant signs of progress. It is advisable to fully inform the public of what can be expected and, where possible, to include practices that yield short-term as well as long-term results.

Management Techniques

Prescribed Burning

Controlled burning is a tool that allows land managers to effectively and economically manage sizable natural areas using a natural process that was historically part of the landscape. It is the single most important management technique at their disposal. Depending on the setting and proximity to man-made structures, burning can also be a useful tool in native landscape projects.

Planning is the key to successful use of controlled burning as a management tool. Although controlled burns are essential to long-term health of natural areas, they can have short-term impacts upon some plant and animal (primarily insect) life. For this reason, sites are either burned in portions or on a landscape level that allows natural patchiness to provide refuge.

Controlled burns as applied today have several beneficial effects upon degraded or restored natural communities. One of the most important effects is controlling woody brush encroachment by damaging and stressing saplings and seedlings. A second important effect is stressing plants that are not adapted to fire, such as non-native cool season grasses. This allows native species that are adapted to fire to compete better with the invasive species that are not adapted to fire. A third effect is the recycling of nutrients, which are released from dead vegetation by the fire. Studies have shown that immediately after a fire, plants grow taller, they flower more and longer, and they produce more seed. Fourth, fire exposes the soil and sprouting plants to sunlight and warmth earlier in the year than in unburned areas, allowing earlier growth and more robust plants (Pauly 1997).

A good controlled burn plan includes a clear statement of goals and objectives, a map of burn units, and a prescription that defines the safety parameters: required limits for wind direction and speed, relative humidity, and temperature. The plan also should include optimum timing and conditions, and it should describe the tools and personnel required. Typically, it includes a smoke-management strategy, a notification list, and evidence of all required permits. Contracts to conduct controlled burns should include requirements for preparation of such a burn plan with all of these elements specified in as much detail as possible. Some important references for developing prescribed burn plans are Collins and Wallace (1990), Henderson and Statz (1995), Hulbert (1988), Wright and Bailey (1982), Packard and Mutel (1997), Ladd (1991), and McClain (1994).

Management of Hydrology

Hydrology includes surface water (ponds and wetlands), groundwater (springs, seeps, and subsurface flow), and riparian systems (streams and rivers). A comprehensive approach to restoring and managing the natural communities of any site should include a thorough review of that site's hydrology, both historic and present. Modifications to hydrology in the past century and a half were usually attempts to make land more suitable for farming and development, or to convey water off site as quickly and efficiently as possible. Changes in drainage by ditches, tiles, storm sewers, and other means have greatly altered the habitats and ecology of the region. Instead of infiltrating into the soil and then moving as groundwater through the natural communities, most rainfall and melt water now run off the surface, changing the quantity and timing of water availability for plants and animals. Hydrologic alteration eliminates some native plant communities and degrades the quality of others.

A review of historical information and a field inspection should determine whether a site has undergone hydrological modification by human actions. A number of information sources can be useful. These include soil analysis, physical evidence of drainage alterations such as field tile or straightened stream channels, aerial photos, topographic maps, and personal contacts with previous owners and local officials. The analysis should also consider the effects of off-site alterations to hydrology. Before recommending the restoration of hydrology, a land manager must determine if proposed alterations comply with state drainage laws. For example, will they affect surrounding or downstream property owners? This information may be essential for obtaining necessary federal, state, and local permits. Some important references in planning

hydrological restorations are Brooks et al. (1997), Payne (1992), Mitsch and Gosselink (1993), Galatowitsch and van der Valk (1994), and Hammer (1992). In some cases, hydrologic restoration may not be possible, due to the surrounding human inhabited landscape, and/or permanent hydrologic modifications. A substitute native landscape can be considered if a true restoration is not possible due to these hydrologic considerations.

Control of Invasive Plant Species

The invasion by aggressive species is an international conservation issue of serious concern, because it threatens native biodiversity in regions and preserves across the globe. Invasive species are those that become established or naturalized in local ecosystems or habitat, are an agent of change, threaten native biological diversity, and are often imports from another part of the world. The International Convention on Biological Diversity recognizes invasive species as one of the major threats to biodiversity and calls upon the governments of the world to take steps to prevent the introduction and manage the impact of invasive species. The Chicago Wilderness Biodiversity Recovery Plan specifically identified invasive species as a threat to the biodiversity of the Chicago region.

Invasive plant species are currently causing serious and sometimes devastating damage to terrestrial natural areas in the Chicago Wilderness region, reducing native plant diversity (and thereby associated animal diversity) by successfully competing for space, water, sunlight, and nutrients. Once established, these plants are difficult to eliminate or control. Most of our invasive species are introduced from Eurasia. The spread of these species is recognized as a direct threat to natural communities and to some endangered species.

A plan to control invasive species is an important element in any management plan, whether for a new native planting or an existing remnant natural community. In dealing with invasive species, two important maxims are that prevention is at least as important as eradication and that identifying and resolving the cause of the invasion is a critical step in control. Decisions about specific methods for controlling invasive species depend on several variables including the species involved, the nature of the invasion, surrounding environmental conditions, resources available, and the management objectives for the site. In most cases a combination of control methods works best. Three categories of control are available:

Physical Control

Physical controls include controlled burns, mowing, restoration of hydrological function, cutting, pulling, girdling, and other methods that physically remove or weaken the invasive species, promoting successful competition by natives. Mowing can be effective for the control of some annual and biennial pioneering invaders if native plants are available to provide long-term competition. The timing of mowing is important, both to achieve control and to avoid injury to nesting birds. Hand pulling or removal of seeds can be effective for small areas and for species that can be effectively pulled, but it is labor intensive. Girdling (or cutting through the living bark of a tree around its complete circumference) is an important tool when working in high-quality areas or for creating habitat for cavity-

nesting birds or bats. There are also many tools that have been developed for the physical control of various species that may be applicable especially in situations where chemical control cannot be used. The Midwest Invasive Plant Network (MIPN.org) or the Northeastern Illinois Invasive Plant Partnership (NIIPP.net) are good sources of information about these tools.

Biological Control

Biological control uses the natural enemies and competitors of a species to control its population. Predators or diseases from the place the plant is native and is held in balance with its ecosystem are usually used. These should be host-specific to avoid negative impacts on non-target species. The USDA closely regulates such introductions. Currently biological controls are being implemented for purple loosestrife and Eurasian water milfoil. Another form of biological control is the seeding of native plant species that may in time out-compete invasive species under restored natural conditions.

Chemical Control

Herbicides are by far the most commonly used pesticide in management of natural areas. They are often used in combination with physical or biological controls. In most cases, they are used on a temporary basis with the objective of establishing a balanced condition where the natural processes of fire and competition by native plants will be sufficient to exclude the invasive species. However, in many instances this is not achievable due to a constant input of seeds and other invasive species propagules from the surrounding landscape. Herbicide is commonly used to control brush when it has grown beyond the size controlled by fire and when its shade has limited the availability of fuel for burning.

Before any pesticide can be sold in the United States, it must be registered and approved by the U.S. Environmental Protection Agency. How the pesticide may be used is governed by terms specified in the product label, which has regulatory authority and limits the amounts to be used and the conditions under which application occurs. State governments test and license individuals seeking to apply pesticides commercially or on public land, usually through their departments of agriculture. Land-owning entities may have additional rules about use of pesticides and qualifications of those applying them. Any contractor hired for herbicide application must have the appropriate licenses and follow all label restrictions.

It is important for each project sponsor/landowner to establish priorities for invasive-species control. Of highest importance are:

- preventing new infestations
- targeting the existing problems that are the fastest growing and fastest spreading
- targeting species that are the most disruptive to natural ecosystems
- monitoring for new threats and stopping them before the new species becomes established

The species listed in Table 1 above are particularly problematic invasive plants in the Chicago Wilderness region. These species are currently causing biodiversity loss and, if left unchecked, will cause irreparable damage to our native species and communities. Some native plant species can become invasive under some conditions and the worst of these are included in Table 1.

Management work typically focuses primarily on invasive species control and consists of conducting routine ecological management activities in the restoration or native landscape areas for a project. At the beginning of each year, if using a management contractor they should provide a management schedule that specifies the management activities to be conducted during that year.

Appropriate herbicide products shall be utilized for spraying or wicking to eradicate target invasive species without damaging adjacent native plants. All herbicides shall be utilized per the manufacturer's recommendations and labeling. Unless being conducted on private property by the owner, all herbicide must be applied by a State Licensed Operator or Applicator with familiarity and experience conducting weed eradication within natural areas or native landscapes. A copy of a valid license (State of Illinois Department of Agriculture Pesticide Applicator or Operator) should be provided upon request. The contractor shall perform all herbiciding activities necessary to achieve project performance standards.

Many invasive species have specific herbicides, methods of application, and timing of application that are known to be most effective. The goal is to get maximum uptake of the herbicide systemically into the plant to kill the entire plant. If the herbicide is applied too strong, or under the wrong conditions it can "top-kill" the plant providing good visual appearance of impact, but leave the roots unharmed which then provide for future growth. Thus, the invasive species management plan should anticipate which species may be problematic in any given restoration or native landscaping project, and then outline the chemical, timing, and methods to be used. Many projects require many passes through using different herbicides at different times of year for effective management.

This work can be contracted and paid for at a lump sum price per year per area for ecological management. If contracted in this manner, the annual unit price should include all necessary labor, material and equipment needed to perform the work as specified on the plans. For partial payment of lump sum amount during the year, a contractor can provide a summary memo with an invoice to document the management work performed during the invoicing period. This is a generally recommended approach that works in the favor of the project sponsor. However, in some circumstances that approach may not be feasible or agreeable to a contractor, such that more specific unit prices may need to be contracted such as acres treated or gallons of prepared herbicide used.

Management of Problem Wildlife

The fragmentation of ecosystems in the Chicago Wilderness region and the growing populations of some wildlife species (especially deer) present real challenges to the

conservation of biodiversity. Each native plant and animal species is a valued component of the ecosystem. Some wildlife species, however, are having quantifiable negative impacts upon plant and animal communities and ecosystems. Over abundance of certain animal species can destroy ecological balances, destabilizing relationships within the community and making it vulnerable to invasive species. Such species (native or introduced) can be problems that require careful attention. Some animal species cause damage or inconvenience to people, and some are a threat to rare species and healthy natural communities.

In aquatic communities, the zebra mussel, round goby, rusty crayfish, and common carp can drive other species to local extinction. The Canada goose, though native, has become so abundant (in the absence of natural predators and through creation of artificial habitat) that it pollutes some waterways and conflicts with human uses of its favorite local habitat, mowed lawns. It is also very destructive of efforts to restore wetlands by eating new plantings before they get established.

One of the most serious threats to woodland and other communities in the region comes from white-tailed deer. The continuing development of open lands for human uses removes available deer habitat, concentrating deer in limited remaining open space. These deer consume a great number of plants and, if unchecked, their consumption leads to the loss of native plant species, including endangered species. Deer populations can grow rapidly in the absence of natural predators and regular management. A study of radio-collared deer from DuPage and Cook counties from 1994 through 1998 found that adult deer have high annual survival rates (>80%) and few natural predators. Automobiles and trains accounted for more than 60 % of urban deer mortality (Etter 1998). Populations can more than double annually in the absence of predators if left unchecked. Chicago Wilderness has published a summary paper on white-tailed deer management which can be found at http://chicagowilderness.org/members/downloads/General/CW_Deer_Position_Statement_FINAL_APPROVED.pdf

In the context of native landscaping and restoration projects, the main issue is the protection of new plantings from herbivory by some of the nuisance species. Typically, wetland/emergent plantings need protection from predation by Canada geese. Upland plantings, especially of shrubs, need protection from browsing by white-tailed deer. Depending on the location and wildlife species present at any given project site, other species may also warrant some special protection measures during the management and monitoring phase of the project.

Because Canada geese are migratory birds, they are protected by federal as well as state regulations. Consequently, you must obtain special permission before taking any lethal control action. Special permission is not needed for non-lethal methods that do not

physically harm the birds, their nests, or eggs. Exclusion methods prevent Canada geese from entering a specific area with newly planted vegetation. Some methods are inexpensive and simple, while others are more complex and costly. Exclusion can be very effective, especially when used in conjunction with other management tools.

Because geese can fly, fencing alone may not exclude them from an area. Fencing along the shoreline of a pond or wetland will prevent geese from walking from water onto shore where emergent plantings may be located. Consider conventional woven wire, snow, chain-link, and picket fences, single or dual strands of cord or wire, or chicken wire.

Often used in conjunction with other exclusion methods, mylar tape helps create a visual barrier. The tape is one-half inch wide, red on one side and silver on the other. To use as a fence, string one or two strands between two posts, twisting the tape two or three times as you put it up. The tape flashes in the breeze and makes the geese nervous, encouraging them to go elsewhere.

A grid system above the water's surface is a very effective exclusion method and often used to protect new emergent plantings. Sometimes referred to as "goose grid", they work on a simple principle: Canada geese are large and require a long glide-slope to land, and a grid system denies them that.

Grids work best on bodies of water or wetlands less than 150 feet across, but can be used on bodies up to 300 feet across. Use nearly any type of cordage to construct the grid, from cotton kite string to plastic-coated Kevlar cord. Anchor points for the grid lines can be trees, wooden stakes, or metal fence posts. Grid specifications can be variable, but grid lines spaced 20 feet apart and suspended at least 3 feet above the water should exclude geese while still allowing access by ducks, gulls, and other smaller birds. The grid can be adjusted if water levels change or if geese penetrate the system by landing on the shore and walking under the grid into the water. One solution would be a barrier along the water's edge. For example, attach two strands of cord, 6-inches and 12-inches above the ground and running the length of the shore, to the anchor points.

Requests for a chemical spray to repel geese are common, but relatively few over-the-counter products are available because of strict registration requirements. To be registered, a product must achieve the manufacturer's claims with little or no adverse environmental impacts. Use of these products does not guarantee success and they should be employed as part of an integrated management plan. Moreover, most products have not been found to be very effective over time in the Chicago Wilderness region.

Deer browse of woody and other upland plantings can also require protection. It is difficult to move deer out of areas where they are not wanted. A hungry deer will find almost any plant palatable, so no plant is "deer proof" though some are less palatable than others. New tender plantings are often favored. Two types of deer repellents that can be used are contact repellents and area repellents. Netting can also reduce deer damage to shrubs and small trees. Adequate fencing to exclude deer is the only sure way to prevent deer damage.

The two types of deer repellents are contact repellents and area repellents. Contact repellents are applied directly to plants, causing them to taste bad. Area repellents are placed in a problem area and repel by their foul odor. Repellents are generally more effective on less preferred plants. Apply repellents on a dry day with temperatures above freezing. Treat young trees completely. Older trees may be treated only on their new growth. Treat to a height 6 feet above the maximum expected snow depth. Deer browse from the top down. Hang or apply repellents at the bud or new growth level of the plants you wish to protect.

Home-remedy repellents are questionable at best. These include small, fine-mesh bags of human hair (about two handfuls) and bar soap hung from branches of trees. Replace both soap and hair bags monthly. Deer have been reported to eat the soap bars. Materials that work in one area or for one person may not work at all in an area more highly frequented by deer.

Commercially available tubes of netting around individual seedlings are an effective method to reduce deer damage to small trees or shrubs. The material degrades in sunlight and breaks down in three to five years. These tubes can protect just the growing terminals or can completely enclose small trees. Attach tubes to a support stake to keep them upright. Another option is flexible, sunlight-degradable netting that expands to slip over seedlings.

Additional options include invisible mesh barriers, slanting deer fences, and single-wire, electric fences baited with peanut butter. The invisible mesh barriers are polypropylene fences of various mesh sizes, typically 8 feet high with a high tensile strength, which blend in with the surroundings. The baited fences attract deer to the fence instead of what's inside the fence. They administer a safe correction that trains the deer to stay away. They are effective for small areas of new plantings that are subject to moderate deer pressure. Deer are attracted by the peanut butter and encouraged to make nose-to-fence contact. Deer, like many wild animals, seem to respect and respond better to electric fencing after they become familiar with the fenced area.

Monitoring

While land managers use the best available knowledge about communities and species, there is always opportunity and need to improve management techniques and to learn more about ecosystems. Management and monitoring need to be organized so that they help evaluate the effectiveness of current management techniques. Making use of

monitoring results in future management decisions is referred to as adaptive management.

As indicated in the beginning of this Guide, the monitoring design should be driven by the project purpose and goals. If the project purpose is ecological restoration, the monitoring design will differ and likely be more quantitative and rigorous, than if the project is strictly an aesthetic native landscaping project for an office campus. Both have overarching goals rooted in conserving the biodiversity of the region, but the performance standards and monitoring design may be very different. The monitoring program must produce information that can be used to determine if the agreed upon performance standards are being met.

Monitoring of Native Landscape Installations

The following individual monitoring protocols should be implemented to determine conformance with Performance Criteria established in contract documents.

1) An inventory of all naturally landscaped areas (*i.e.,* all detention basins and wildflower and native grass zones) to determine the extent to which species planted/seeded have become established and the extent of undesirable species;

2) The establishment of photographic monitoring locations; and

3) Routine inspections to evaluate soil stability and other maintenance concerns.

The first two protocols shall be performed annually in late summer (August - September). Inspections to evaluate erosion and other maintenance concerns shall be performed four times per year, and more frequently during the initial construction and planting. Each protocol shall be performed for a minimum of three full growing seasons, or until it is evident that plant system development has stabilized and meets all Performance Criteria.

1) Inventory of all naturally landscaped areas: This inventory shall determine overall vegetative cover, the total number of seeded and planted species present and living, the total number of native species present, and the prevalence of undesirable/invasive species, consistent with the specified Performance Standards. This inventory is critical to determine where follow-up seeding or planting are needed and to identify, locate, and remove undesirable plants on a seasonal and yearly basis.

2) Photographic documentation: Photographs shall be taken to document the establishment of vegetative cover, erosion problems, and any other relevant maintenance concerns. The photographs must be of satisfactory quality and resolution to accomplish the intent of the Performance Standards. For consistency, photographs of each planting zone shall be taken from the same locations during each monitoring event. The location

and orientation of each numbered photograph shall be identified on an aerial photo included with the report. Additional photos should be taken of problem areas and remedial activities.

3) Routine inspections to evaluate soil stability and other maintenance concerns: Notation of areas and type of erosion (*e.g*., rills, gullies, and slumping) shall be depicted on a site plan.

An annual monitoring report shall be submitted to the owner/project sponsor in and this report should include the following items:

- Data on the status of the vegetation, including an assessment of compliance with the Performance Standards.
- A description of vegetation maintenance activities, including overseeding, replanting, and control of undesirable species, undertaken during the previous 12 months, and an assessment of their effectiveness in meeting the Performance Standards.
- Photographs, and accompanying descriptions, taken at established locations.
- A discussion of erosion control and other maintenance activities undertaken during the previous 12 months.
- A discussion of planned maintenance activities for the coming year.

For ecological restoration projects, monitoring may consider the following approach.

An indicator is a variable that measures change toward a goal/objective or performance standard. A single indicator may be sufficient to answer our questions about progress toward a particular goal or standard, but usually multiple indicators that draw from several levels of organization and that address some combination of composition, structure, and function will be needed. The key is to find the smallest set of indicators that will give confidence in conclusions about meeting performance standards. For example, an indicator might be the number of native forb species present and alive within the project planting area. This would be an indication that some level of plant diversity has been achieved, toward the goal of restoring a diverse native plant community.

A threshold is a value of an indicator that, when crossed, sends up a “red flag” calling for a management response. This threshold may be tied to status (*e.g*., “respond if the population of species A declines to 500 individuals”) or to a trend (*e.g.,* “respond if the population of species A is declining by 10 individuals per month”). An example here might be a certain percentage of the project area covered by a particular invasive species, such as garlic mustard. When this threshold of cover is exceeded, it should trigger a management action or response.

Red flags may go up quickly, in this type of adaptive management system, and actions must occur in a timely fashion. A range of response actions may need to be considered. For the most part, responses should be directed toward sources of threats to project success. For the garlic mustard example, it may be that if the percent cover in the

project area exceeds 10% then hand-pulling is called for, but if the percent cover exceeds 25% then herbicide control be may necessary.

Once monitoring indicators, thresholds, and responses have been determined, a sampling design, including intensity of monitoring and methods of data collection, should be devised. The methods must be not only scientifically sound but also as simple and cost-effective as possible. Ecological restoration monitoring at a given project site to determine if performance standards have been met, can also be part of larger-scale monitoring of our biodiversity conservation across the Chicago Wilderness region. True ecological management is an ongoing process that will have various milestones but may not ever have an endpoint at which management can cease.
Following is a suggested sample ecological restoration monitoring specification language that can be adapted for various projects. Note that there are specifics that would need to be determined for each in several of these items.

Ecosystem restoration monitoring and reporting shall be conducted in accordance with the following requirements for the duration of the 3-5 year management and monitoring period.

1. *The contractor/consultant shall establish a sufficient number of permanent straight line sampling transects to provide representative coverage for each distinct plant community or zone. The contractor shall locate transect endpoints using GPS and plot all transects on project drawing. If desired and appropriate permanently mark transect endpoints on the ground surface in the field with a metal pipe (e.g., garden T-post) or some other appropriate method.*

2. *On an annual basis during the management and monitoring period, the contractor/consultant shall conduct quantitative vegetative sampling along all transects, preferably at the same time each year (i.e., within 10 days of previous years' sampling). The contractor shall place a series of sample quadrats at regular or random distance intervals along the transects and record percent aerial coverage of each plant species within each quadrat. If statistical analyses are contemplated, the random distances along the transect are needed for statistical validity. However, if regular distances (e.g. every 2 meters) are used it is more assured of capturing all of the variability along the transect and can still be very powerful for determining if performance standards are met.*

3. *The contractor/consultant shall conduct a floristic inventory of all plant communities in the restoration areas twice per year during the management and monitoring period. The first floristic inventory shall be conducted during May/June and the second shall be performed in conjunction with the July/August transect sampling. The data collected shall be analyzed and evaluated using the Floristic Quality*

Assessment (FQA) Computer Program which can be found online at http://universalfqa.org/login.

4. *The contractor/consultant shall maintain photo documentation of site conditions and activities conducted throughout the management period. In addition, the contractor/consultant shall establish several permanent photo points in the restoration area to document changes throughout the management period. These photos shall be incorporated into annual monitoring reports.*

5. *If soils information is determined to be important in the project, the contractor should collect soil data from each of the plant communities in the restoration area from a 30" deep soil pit, or through use of a hand soil probe. The soil sampling point should be located outside the boundary of a sample quadrat in an area that has a similar landscape position and vegetative characteristics as the quadrat. Record a detailed profile description of the soil, using the Munsell color chart, as well as, soil texture and structure. Include the presence of redoximorphic features such as iron/manganese accumulations, oxidized rhizospheres, and depleted zones in the profile descriptions. Record the type, relative abundance, location, and color of these features. Examine the soil in this location annually, and compare with an undisturbed soil profile described each successive year. In most native landscape type projects this item will not likely be of importance or necessary.*

6. *If hydrology is important to the success of the project, which would be the case in all wetland plant communities, some form of hydrology monitoring will be necessary. Many restorations and wetland mitigation areas fail due to the hydrology being different than what was planned or predicted. Hydrology monitoring can include simple manually measured monitoring wells, where one records the depth to the water surface in the well and then subtracts the height of the well above the ground surface to determine the depth to the water table. Staff gauges can be used to measure the depth of water in surface water features. Automated continuous water level recording devices can also be used and data downloaded from them into laptop computers. These have become very commonly used, but seem to be targets of vandalism.*

7. *The contractor/consultant shall prepare and submit an annual monitoring report to the project sponsor/owner by January 31 of the following year for each year of the management and monitoring period. The monitoring report must document the vegetation, soils, and hydrologic data collected during the year's monitoring inspections. The annual report must include a review of site progression towards meeting the performance standards and propose any necessary management actions. More specifically, the monitoring report must contain the following*

information, which will be based on data collected during the monitoring inspections.

- *A vegetation map exhibit based on as-built survey prepared following completion of planting activities shall be submitted with the first year monitoring report. The exhibit must define the limits of the various plant communities and indicate the dominant species within each community. Locations of the permanent vegetative transects, photopoints, and soil monitoring must be depicted on this exhibit as well (these points can be located via GPS).*
- *A summary of management activities conducted during the year, including a description of the activities, dates, areas treated, herbicide logs, and results.*
- *Representative photographs depicting general site conditions.*
- *Calculate native mean Coefficient of Conservatism (C) and native Floristic Quality Index (FQI) values (w/ and w/o adventives) for each quadrat. This information can be used to identify any problem areas located within the restoration area.*
- *Calculate native mean C and native FQI values for each plant community zone, and for the entire restoration area.*
- *Evaluate the status of the restoration area relative to the performance standards.*
- *Prepare a plan and schedule of management activities for the following year.*

If the project purpose includes water quality goals, or aesthetic landscaping goals monitoring protocols should be established to address those performance standards. These may include monthly inspections of sediment accumulations and a planned threshold for sediment removal, or it may include collection of water samples at inlets and outlets for laboratory analysis of nutrient or other pollutant content.

Institutional Arrangements (e.g., ownership, conservation easements, back-up SSAs, bonding, other securities, etc).

There are many aspects to the arrangements we have grouped here in this section. These pertain to the protection of both the property being restored or landscaped, and protection of the project sponsor or client. Each of these tools and issues are discussed to provide general information and recommendations.

Ownership and Easements.

The ownership of the property where the restoration or native landscaping project occurs can be a key consideration. In most cases, the owner is probably the project sponsor and the one seeking a contract. However, in some cases the property may be held by a third party or by an association. In these cases there must be documentation making it

clear that the project sponsor has the legal right to affect the project on the property. The contractor does not want to get involved in a dispute over their ability to do work on the property.

From a local government's perspective, it also is important that the ownership entity has both the responsibility and capability to maintain the site in the future in an aesthetic and ecologically sustainable condition. The ultimate owner of natural open space, as well as the entity responsible for maintaining it, should be identified and should be made part of the property's Covenants and Restrictions. Preferred ownership options for open space include qualified public or private land conservation organizations that have experience in the stewardship of natural lands. Appropriate organizations may include forest preserve or conservation districts, park districts, township open space agencies, or land trusts. This option is particularly appropriate for natural open space created as part of a conservation development. Alternatively, ownership of common open space may reside with a homeowners or property owners association.
Regardless of the property ownership, another layer of protection may be necessary to ensure that the natural landscape or restoration area is well maintained in perpetuity consistent with the performance criteria identified previously. A conservation easement is a useful tool in protecting natural areas and restoration investments, and thus the biodiversity of the region. An easement is by definition an instrument granted to a third party. Terms and restrictions governing the use and management of the property can be included in the easement contract language. It is then the responsibility of the third party recipient of the easement to enforce those terms and restrictions. For conservation easements, this is often a non-profit organization such as a land trust that is equipped to take on this type of responsibility. They can also then be actively involved in management decisions in the ongoing management of the property.

An easement is similar to a deed restriction in that both can include contract language to protect the property and restrict future uses and management. However, a deed restriction is simply recorded on the property deed or title with the county. There is no third party involved, and hence enforcement of the terms is a voluntary action on the part of the landowner. Deed restrictions can "run with the land" though, which causes the terms and restrictions therein to transfer to any new landowners. However, any given landowner can remove a deed restriction. A conservation easement on the other hand is also recorded with the county, can run with the land, but always has that third party monitoring and enforcing the terms of the easement.

Financial Sureties

Both bid and performance bonds are financial guarantees that a contractor will complete a job to the specifications of a contract. In the event a contractor does not finish a project or adhere to contract requirements, the sponsor/owner can make a claim against bond. The bonding or insurance company will pay the obligee and go back to the contractor for 100% reimbursement. This is very different from liability insurance, which will provide coverage for damages caused by a contractor's operations.

Since the bonding company is basically making an "unfunded" loan, a contractor would have to prove that their company is in a position financially to make reimbursement to

them. Thinking in terms of a loan then, there is a limit that a contractor would be qualified to obtain a bond for, and this amount is inclusive of all other bonds a contractor may have outstanding. Bonding companies will typically be looking to issue bonds for projects that will take up to 12 months to complete, as they underwrite the financial position each year. Sometimes a bonding company may issue a bond for up to 24 months, but projects that run longer than this would require collateral (cash deposit) of up to 100% of the bond amount be held in an account until completion. This can be problematic for projects that will take longer than 24 months to complete or to determine if the contract has been satisfied, which is often the case in native landscaping or ecological restoration projects. This is a distinct challenge that many contractors struggle with for the longer term restoration and native landscaping projects. In addition, while most bonding companies have a minimal or no charge for the bid bonds, the cost for performance bonds is typically 2.5 to 3% of the project total. Many government agencies require some type of bid and/or performance bonding.

In lieu of purchasing a bond, you can also obtain a bank letter of credit or an irrevocable letter of credit. This however, actually ties up a contractor's buying/borrowing power and also carries a fee, as well as, appearing on either personal or business credit reports for the length of the contract. This mechanism is sometimes favored by the U.S. Army Corps of Engineers and other wetland regulators for wetland mitigation projects, but is often not acceptable to local units of government that require bonds.

There also is a need to provide secure and permanent funding arrangements for the long-term management and maintenance of common open space, deed-restricted open space, and stormwater facilities once responsibilities are turned over to a local government unit, conservation entity, or a homeowners/property owners association. Such funding arrangements should, where appropriate, be noted and made part of the Covenants and Restrictions.

Special Service Areas (SSA)

Special service areas are another mechanism that municipalities can use to fund maintenance of various assets. Under an SSA, each property owner is assessed a certain fee for maintenance of common areas or structures. Many communities don't like using SSAs as they are viewed as a negative factor in attracting buyers, especially in residential developments. However, back-up SSAs can be put into place at the time of development and the initial restoration or native landscaping work. These back-up SSAs remain dormant and no fees are assessed under normal circumstances. They can then be activated if some other funding mechanism fails and/or budgeted dollars fall short of those needed for essential maintenance activities.

Long-term Stewardship Plan

To further ensure that the natural landscape or restoration area is maintained in the future, a legally-binding stewardship plan should be developed by the project owner/sponsor and approved by the appropriate unit of local government. The Stewardship Plan should be prepared by a qualified specialist in the field of ecological restoration or native landscaping. The plan should include long-term provisions for the maintenance and

monitoring of natural areas in perpetuity. For projects associated with development, the plan shall be approved as part of the subdivision review process and recorded in the covenants for the subdivision.

The plan should contain text and appropriate maps and/or graphic renderings that identify the various management units on a site. The plan should provide specific details and methods regarding the preservation and management of open areas and natural resources in perpetuity. It shall be in a format that is easily understood and shall identify the "who, what, when, and where" of specific tasks which must be completed in order to ensure the long-term viability of current and future resources on the site. The plan shall address and/or allocate the long-term maintenance and monitoring of subject areas and should identify the responsibility and guidelines for performing said tasks. It also should include any necessary provisions for replacement costs and long-term capital improvements.

The stewardship plan also can serve as an educational resource for future residents and property owners. It should clearly designate and map the ownership of natural features and dedicated open space. It should allocate responsibility and guidelines for the maintenance and operation of the dedicated natural areas. And it should include estimated costs for maintenance, inspection and operation of the dedicated natural areas. More specifically, the plan should describe the means by which such funding will be obtained or provided and require agencies, private firms, etc. contracted to perform long-term stewardship work, to submit a valid certificate of insurance.

Assurance of Professional Land Stewardship and Management Capabilities

Most local governments will want assurances that the long-term stewardship of natural landscapes and restored areas will be in qualified hands. Therefore, for the management responsibilities for native landscapes and restoration areas a management entity with demonstrated experience and qualifications in native land management and ecologic stewardship should be chosen. The local government may wish to identify a list of qualified contractors/entities, or could adopt the criteria identified in this document under "minimum firm qualifications and experience".

For natural areas within residential developments (e.g., conservation developments), local governments may want to clearly specify management responsibilities to be borne by homeowners/property owners associations and their contracted management entity. These responsibilities may include:

1. Enforcement of Covenants, Conditions and Restrictions (CCRs) and the Stewardship Plan,
2. Proper budgeting and managing finances for HOA/POA or easement holders,
3. Collection of dues and/or fees,
4. Filing of required reports and taxes,
5. Education and communication with residents,
6. Insurance and risk management, and
7. Maintenance of adequate reserves.

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