



The Sanctuary of Bull Valley Ecological Assessment and Restoration Plan

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COMPLETED FOR KNICKERBOCKER PROPERTIES, LLC.

Prepared by

William W. Stoll, M.S.; John L. Larson, Ph.D.; Mark J. O'Leary, M.S.; and Craig Tuttle

Applied Ecological Services, Inc.

17921 Smith Road, P.O. Box 256, Brodhead, Wisconsin 53520-0256

608/897-8641 Phone 608/897-8486 Fax

I. Introduction

In October 2002, Knickerbocker retained Applied Ecological Services (AES) to design a plan for restoring native vegetation (i.e. woodland, savanna, prairie, and wetland) in the common properties and Deed-restricted Open Space areas within The Estates area of The Sanctuary of Bull Valley development (Phase I) in Woodstock, Illinois (See Figure 1). Knickerbocker Properties, LLC, was required by the City of Woodstock to maintain at least 47% of the estate area as open space. The final plat indicates 50.8% of dedicated open space. The City imposed this requirement, in large part, to maintain infiltration on the site because, according to the Illinois State Water Survey, the site is believed to be an important recharge area for Boone Creek Fen Nature Preserves located approximately one mile northeast of the site. According to an Illinois DNR review of the General Land Office survey notes, the site's pre-settlement vegetation included savanna with a large pocket of prairie in the eastern half (See Figure 2).

II. Existing Conditions

An AES ecologist visited the site in October 2002 and assessed the current vegetation and land cover. In summary, the site contains a mix of agricultural fields and woodlands, along with old field, pasture, and a wetland (See Figure 3). In addition, the site sits on kettle-moraine topography and contains 13 kettles. According to a hydrogeologic study by Schneider Geoscience, these kettles are likely the areas of greatest recharge to groundwater.

Bean Field

All agricultural fields, found mostly in the eastern and southern portions of the site, were planted with soy beans (*Glycine max*). Pockets of typical agronomic weeds were scattered throughout most of these fields. Giant foxtail (*Setaria faberi*), Japanese chess (*Bromus japonicus*), and nodding thistle (*Carduus nutans*) were the most common weeds in these fields. Canada thistle (*Cirsium arvense*), dandelion (*Taraxacum officinale*), and Canada goldenrod (*Solidago canadensis*) were also present.



Bean field in the northeast portion of site, looking north



Bean field in southern portion of site, looking south

Old Field

An old field with some young woody growth is found at the northeast corner of the site along Country Club Road. This area is dominated by Canada goldenrod, Kentucky blue grass (*Poa pratensis*), Queen Anne's lace (*Daucus carota*), and quack grass (*Agropyron repens*). Siberian elm (*Ulmus pumila*) and tartarian honeysuckle (*Lonicera tatarica*) are the most common woody species. Other species found in the field include smooth brome (*Bromus inermis*), sweet clover (*Melilotus* sp.), orchard grass (*Dactylis glomerata*), hairy aster (*Aster pilosus*), common buckthorn (*Rhamnus cathartica*), red cedar (*Juniperus virginiana*), and white pine (*Pinus strobus*).

Pasture/Kettles

Three kettles are found within the wooded area in the northwest portion of the site. The largest, near Country Club Road, appears to be an old paddock area. These areas are dominated by smooth brome, Canada thistle, reed canary grass (*Phalaris arundinacea*), and stinging nettle (*Urtica procera*). Other species include multiflora rose (*Rosa multiflora*), hairy aster (*Aster pilosus*), quack grass, orchard grass, Kentucky blue grass, and burdock (*Arctium minus*).



Southern Kettle in savanna area, looking north



Middle kettle in savanna area, looking east

Oak Savanna and Woodlands

A historic oak savanna dominated by mature open grown bur oak (*Quercus macrocarpa*) and white oak (*Quercus alba*) is found in the northwest portion of the site. Red oak (*Quercus rubra*) and shagbark hickory are also common in the area. Most of the mature red oaks are found in the more densely wooded area (i.e. woodland) at the south end of this cover type. Young weedy trees are common throughout this area, including wild black cherry, box elder, white mulberry, and Siberian elm. Other native trees include black oak (*Quercus velutina*), bitternut hickory (*Carya cordiformis*), basswood (*Tilia americana*), black walnut (*Juglans nigra*), cottonwood (*Populus deltoides*), and sugar maple (*Acer saccharum*). Numerous planted trees, such as white pine and Norway maple, are found around the house. Non-native and weedy native shrubs are dense in many areas of this savanna, including common buckthorn, Tartarian honeysuckle, blackberry (*Rubus allegheniensis*), black raspberry (*Rubus occidentalis*), and multiflora rose. The herbaceous ground layer is shade-suppressed in the heavily wooded areas, but it is abundant in open areas and dominated by weedy or non-native species, such as smooth brome, Kentucky blue grass, orchard grass and Canada

golden rod. Other herbaceous species in the savanna and woodland include Queen Anne's lace, garlic mustard (*Alliaria petiolata*), sweet cicely (*Osmorhiza* sp.), false Solomon's seal (*Smilacina* spp.), burdock, stinging nettle, Japanese chess, may apple (*Podophyllum peltatum*), enchanter's nightshade (*Circaea lutetiana canadensis*), black snakeroot (*Sanicula gregaria*), white avens (*Geum canadense*), and reed canary grass (*Phalaris arundinacea*).



Savanna understory near Lot 11



Savanna near Lot 10, looking northeast



Savanna near Lot 19, looking east

Young Woods

The young woods found along the tree lines on the site are dominated by wild black cherry, box elders, common buckthorn, and tartarian honeysuckle. Other trees in these fence rows include American elm, Siberian elm, red oak, bur oak, shagbark hickory, hackberry (*Celtis occidentalis*), white mulberry, cottonwood, white pine, and silver maple (*Acer saccharinum*). Other shrubs include multiflora rose, black raspberry, blackberry, and gray dogwood (*Cornus racemosa*). Garlic mustard, smooth brome, orchard grass, and Canada Goldenrod are the most common herbaceous species in the ground layer. Other species include Queen Anne's lace, annual fleabane (*Erigeron annuus*), stinging nettles, motherwort (*Leonurus cardiaca*), burdock, pokeweed (*Phytolacca americana*), Timothy (*Phleum pratense*), Kentucky bluegrass, stickseed (*Hackelia virginiana*), white avens, and giant foxtail.



Bean field with tree row east of outlot D in the distance.



Tree row on west side of Lots 70 and 71, looking north.

Wetland

A degraded sedge meadow is dominated by reed canary grass located near the north end of the west side of the site. The reed canary grass is growing on hummocks that were most likely created by tussock sedge (*Carex stricta*). Barnyard grass (*Echinochloa crusgalli*) and blunt spike rush (*Eleocharis obtusa*) were also found in this wetland.

III. Restoration and Management Plan

This section of the report outlines a plan for restoring, enhancing, and managing native prairie, savanna, woodland, forest, and wetland vegetation in all designated common properties and DROS areas within The Estates of The Sanctuary of Bull Valley development (Phase I). The purpose of this section is to identify the restoration needs and potentials of all these areas in the context of the client's land use goals: To enhance the aesthetics and the health of the ecosystem in all designated open space areas by restoring them to ecologically appropriate native vegetation.

Planting native ground layer vegetation (i.e. prairie) to maintain the quantity and improve the quality of on-site water infiltration for recharge and preserving large old trees (e.g. oaks and hickories) are particularly important restoration goals. This section develops a framework that describes the recommended restoration and management objectives, tasks, and performance standards for each restoration unit identified in the Restoration Plan Map. (Sheet 1). The Restoration Schedule (Table 1) and all other restoration plans and documents (Sheets 1-6) are found at the end of this plan.

Oak Savanna Restoration

Objective

Restore historic open oak savanna consisting of scattered oaks and shagbark hickory with an understory of herbaceous prairie and savanna species.

Strategy

This will be achieved by installing prairie and savanna understory species (i.e. seed and plants), preparing soil (i.e. herbiciding) where needed, removing non-native and weedy native woody species to achieve an appropriate savanna canopy structure (i.e. no more than 50% cover), and installing oaks, hickories, and native shrubs where needed.

Tasks

The following tasks are needed to restore oak savanna on the site.

1. Plant and establish Dry-mesic Prairie seed mix or cover crop in all currently tilled agricultural fields (i.e. beans) designated as open space areas (either common properties or DROS) in the Phase I area of the property. This was completed in November 2002.
 - Details found in Pre-construction Planting Plan (Sheet 3).
2. Remove all non-native woody understory species (i.e. shrubs and small trees) and thin selected weedy native woody species from tree row areas.
 - This was completed by a local contractor in some tree rows during the fall or winter of 2003.
 - Stump herbiciding followed in the spring of 2003.
3. Remove all non-native tree species and thin selected weedy native trees from tree rows.
 - A list of species and sizes to be removed is found in the Tree Removal Plan (Sheet 4).
 - Most trees will be removed during initial thinning in order to achieve a savanna or open woodland structure (i.e. <50% canopy cover or a percent of cover as determined by existing mature native trees) in the tree rows.



- Tree rows contain relatively few trees of appropriate species; therefore, a number of large weedy native trees (i.e. wild black cherry or box elder) will remain for a number of years (i.e. 10-30 years) as “anchor trees” until planted oaks and hickories mature.
 - Thinning will be completed by a local contractor.
4. Herbicide non-native ground layer species (i.e. garlic mustard and cool season grasses) in tree row areas as needed to prepare areas for the reestablishment of native species.
 5. Plant ecologically appropriate tree species (i.e. burr, white, and red oak and shagbark hickory) and shrubs (i.e hazelnut) in the savanna restoration areas in a density consistent with an oak savanna structure.
 - See proposed tree plantings on the Restoration Plan (Sheet 1), and the Savanna Restoration species list in the Restoration Planting Lists (Sheet 2).
 - As many trees as possible will be transplanted on site. The remainder will be purchased from a nursery (See Sheet 2).
 - Anchor trees will be removed from tree rows when nearby planted oaks and hickories become large enough to provide appropriate savanna canopy cover (i.e. 40-60% cover).
 6. Reestablish shade-suppressed or displaced savanna and woodland ground layer in brushed, thinned, and/or herbicided tree line areas with appropriate native savanna and woodland species.
 - See Savanna Restoration species list on Sheet 2.
 - This will be completed in phases in conjunction with tree and shrub removal (Tasks 2 and 3) and herbiciding (Task 4), where necessary.
 7. Enhance ground layer in savanna restoration areas through over-seeding and plugging to create colorful drifts.
 - See Prairie Enhancement Drifts species list on Sheet 2.
 - This will be done throughout this zone in drifts to add color and diversity to more visible locations in the open space areas (See Sheet 1).

Monitoring and Short-term Maintenance

Short-term maintenance of a restoration site is typically considered to be the first five years of restoration and management. All restoration tasks are usually completed and management begins during this time period.

- Monitor restored areas. An AES ecologist shall visit and assess all restored areas twice during each growing season.
- Mow seeded prairie areas once or twice a year during years one and two.
- Spot-herbicide invasive species in brushed savanna areas (i.e. garlic mustard) and seeded prairie areas (i.e. Canada thistle), as needed.
- Conduct a prescribed burn during at least two of the first five years of management.

Long-term Maintenance

- Monitor and maintain restored areas through prescribed burning and spot herbiciding, as needed.
- Remove anchor trees (i.e. wild black cherry or box elder) as planted oaks and hickories mature in order to maintain about 40-50% canopy cover (i.e. at least 60% of the available light can reach ground-layer vegetation).



Performance Goals

The following performance goals shall be met by the end of the short-term maintenance period (i.e. by the fifth year of restoration and management).

- Reduce woody plant cover so that at least 60% of the available light can reach ground layer vegetation (or as much light as the mature native canopy determines).
- Non-native woody vegetation shall not exceed 10% of the total cover (with the exception of anchor trees).
- At least 80% of the installed herbaceous species shall be present, and at least 60% of the total ground cover shall be native species.
- All nursery stock trees and shrubs shall survive for one year after planting.
- 60-70% of transplants are expected to survive. However, transplant survivorship is not guaranteed.

Oak Savanna and Woodland Enhancement

Objective

Enhance and restore the overgrown and degraded oak savanna and woodland areas of the property to their historic character and increase their biological diversity.

Strategy

This will be achieved by removing non-native and weedy native woody species to achieve an appropriate savanna and woodland shrub and canopy structure; installing prairie, savanna, and woodland understory species (i.e. seed and plants); and preparing soil (i.e. herbiciding) for seeding, where needed.

Tasks

The following tasks are needed to enhance oak savanna and woodlands on the site.

1. Remove ("brush") all non-native woody (i.e. shrubs and small trees) understory species and thin selected weedy native species from existing oak savanna and woodland areas.
 - This task was completed by a local contractor during fall 2002 and winter 2003 for the entire Savanna Enhancement area.
 - A local contractor herbicided stumps following brushing.
 - Remaining brushing is scheduled for next season.
2. Remove all non-native trees and thin selected weedy native tree species from overstocked oak savanna and woodland areas.
 - A list of species and sizes to be removed is found in table on the Tree Removal Plan (Sheet 4).
 - Some substantial thinning (i.e. box elder) occurred during the brushing phase.
 - Removal of these trees will be completed in phases over a number of years by a local contractor.



- Appropriate tree canopy will be largely determined by the density of mature native ecologically appropriate trees. Appropriate seeding list (i.e. savanna or woodland) will be determined by the mature native canopy cover.
 - + Areas with approximately 40% or less canopy cover shall be considered savanna and planted to savanna understory species.
 - + Areas with greater than approximately 40% canopy cover shall be considered woodland and planted to woodland understory species.
 - + See Restoration Plan Map (Sheet 1) for current seeding zones.
- 3. Herbicide non-native ground layer (i.e. garlic mustard and cool season grasses), where needed, in order to prepare site for the reestablishment of native understory species (i.e. herbaceous and woody).
 - Herbiciding may be completed in phases as determined by client.
 - Herbiciding of garlic mustard will likely require more than one season.
- 4. Reestablish shade-suppressed or displaced savanna and woodland ground layer in brushed and thinned and/or herbicided areas with appropriate native savanna and woodland species (see species list on Sheet 2).
 - Client will remove wood chips and other woody debris from the savanna and woodland floor to the greatest extent possible.
 - Burn brushed savanna woodland area and monitor ground layer response.
 - Install native savanna seed to the extent necessary to restore native cover and diversity in the ground layer.
 - Native shrubs will be planted throughout this zone.
 - Plant plugs will be installed near lots to enhance diversity and aesthetics.

Monitoring and Short-term Maintenance

Short-term maintenance of a restoration site is typically considered to be the first five years of restoration and management. All restoration tasks are usually completed and management begins during this time period.

- Monitor restored areas. An AES ecologist shall visit and assess all restored areas twice during each growing season.
- Spot-herbicide invasive species in brushed savanna and woodland areas (i.e. garlic mustard), as needed.
- Conduct a prescribed burn during at least two of the first five years of management, or as frequently as fuel loads allow.

Long-term Maintenance

- Monitor and maintain restored areas through prescribed burning and spot herbiciding, as needed.

Performance Goals

The following performance goals shall be met by the end of the short-term maintenance period (i.e. by the fifth year of restoration and management).

- Tree removal shall follow Tree Removal Plan (See Sheet 4). The existing large oaks and hickories shall determine the appropriate canopy cover (i.e. woodland or savanna)
- Non-native woody vegetation shall not exceed 10% of the total cover.



- At least 80% of the installed herbaceous species shall be present, and at least 60% of the total ground cover shall be native species.
- All planted shrubs shall survive for one year.

Mesic Forest Restoration

Objective

Restore mesic forest native to the area consisting of a canopy of maples, basswood, oaks, and ash with an understory of native forest woody and herbaceous species.

Strategy

This will be achieved by removing non-native and weedy native woody species, preparing soil (i.e. herbiciding), installing mesic forest trees to establish an appropriate forest canopy structure, and installing native woody and herbaceous understory species (i.e. seed and plants).

Tasks

The following tasks are needed to restore mesic forest on the site.

1. Remove (“brush”) all non-native woody understory species (i.e. shrubs and small trees) and thin selected weedy native woody species from tree row areas.
 - This has been completed by a local contractor in the tree row adjacent to Outlot D.
 - Stump herbiciding followed brushing this spring.
 - Remaining brushing (along Country Club Road) is scheduled for next season, to be completed by a local contractor.
2. Remove all non-native tree species and thin selected weedy native trees from tree rows.
 - A preliminary list of species and sizes to be removed is found on the Tree Removal Plan (Sheet 4).
 - Most trees will be removed during initial thinning in order to begin the conversion to a native forest and allow enough light for the establishment of planted native forest trees, shrubs, and herbaceous plants.
 - Tree rows contain relatively few trees of appropriate species; therefore, a number of large weedy native trees (i.e. wild black cherry or box elder) will remain for a number of years (i.e. 10-30 years) as “anchor trees” until planted native forest trees mature. Some Siberian elm and white pine will remain along Country Club Road.
 - Thinning will be completed by a local contractor.
3. Herbicide non-native ground layer species (i.e. garlic mustard and cool season grasses) in tree row and old field areas as need to prepare areas for the reestablishment of native species.
4. Plant ecologically appropriate tree species (i.e. maples, basswood, ash, and oaks) and shrubs (i.e. ironwood) in the mesic forest restoration areas in a density consistent with a mesic forest structure.
 - See proposed tree plantings on Restoration Plan (Sheet 1) and the Mesic Forest species list in the Restoration Planting Lists (Sheet 2).



- As many trees as possible will be transplanted on site. The remainder will be purchased from a nursery (See Sheet 2).
 - Anchor trees will be removed from tree rows when nearby planted native forest trees become large enough to provide appropriate forest canopy cover (i.e. more than 70% cover).
5. Establish shade-suppressed or displaced forest and woodland ground layer in brushed, thinned, and/or herbicided tree line and old field areas with appropriate native forest and woodland species.
- Client will remove wood chips and other woody debris from the brushed mesic forest areas to the greatest extent possible.
 - Burn brushed mesic forest area and monitor ground layer response.
 - Mesic Forest seed and plant lists are found on Sheet 2.
 - This will be completed in phases in conjunction with tree and shrub removal (Tasks 1 and 2) and herbiciding (Task 3), where necessary.
 - Plant plugs will be installed near lots and other conspicuous areas (i.e. near roads).

Monitoring and Short-term Maintenance

Short-term maintenance of a restoration site is typically considered to be the first five years of restoration and management. All restoration tasks are usually completed and management begins during this time period.

- Monitor restored areas. An AES ecologist shall visit and assess all restored areas twice during each growing season.
- Spot-herbicide invasive species in brushed mesic forest areas (i.e. garlic mustard), as needed.
- Conduct a prescribed burn during two of the first five years of management, if possible.

Long-term Maintenance

- Monitor and maintain restored areas through prescribed burning and spot herbiciding, as needed.
- Remove anchor trees (i.e. wild black cherry, box elder, Siberian elm) as planted forest trees mature in order to maintain at least 70% canopy cover (i.e. a full, but not completely closed, canopy cover).

Performance Goals

The following performance goals shall be met by the end of the short-term maintenance period (i.e. by the fifth year of restoration and management).

- Convert non-native and weedy native dominated wooded areas to native mesic forest composition and structure. The canopy should be structured (different age and size trees with light gaps) to allow enough light to reach the understory to establish native forest woody and herbaceous understory species.
- Non-native woody vegetation shall not exceed 10% of the total cover (with the exception of anchor trees).
- At least 80% of the installed herbaceous species shall be present, and at least 60% of the total ground cover shall be native species.
- All nursery stock trees and shrubs shall survive for one year after planting.
- 60-70% of transplants are expected to survive. However, transplant survivorship is not guaranteed.



Wet-mesic Prairie Restoration (Kettles and Low Areas)

Objective

Restore native prairie (wet-mesic) vegetation in all kettle depressions and low areas that contain poorly drained soils and/or receive a substantial amount of stormwater runoff.

- Some of these kettles already have been planted with dry-mesic prairie species (see Sheet 6). These kettles, including the large kettle in Outlot C (which contains well-drained soil), will be restored to wet-mesic prairie only if the original planting fails.

Strategy

This will be achieved by preparing the soil for planting (i.e. herbiciding and disking), where needed, and installing native prairie species.

Tasks

The following tasks are needed to restore wet-mesic prairie in the kettles on the site.

1. Kettles in tilled agricultural fields:
 - Seed and plant wet-prairie species after construction (i.e. roads and utility lines) is completed. Plant plugs will be installed in more visible areas to enhance aesthetics (See Sheet 6).
 - Prepare area for seeding by herbiciding, as needed.
2. Kettles in savanna enhancement area:
 - Herbicide non-native ground layer (i.e. cool season grasses, reed canary grass, and Canada thistle) in order to prepare site for reestablishing native species.
 - + Herbicide, disc, and herbicide again in the spring. Disc and/or burn in the fall before seeding.
 - Seed and plant native wet-mesic prairie species in the fall in prepared kettles. Plant plugs will be installed in more visible areas to enhance aesthetics (See Sheet 6).

Monitoring and Short-term Maintenance

Short-term maintenance of a restoration site is typically considered to be the first five years of restoration and management.

All restoration tasks are usually completed and management begins during this time period.

- Monitor restored areas. An AES ecologist shall visit and assess all restored areas twice during each growing season.
- Mow seeded wet-mesic prairie areas once or twice a year during years one and two, where possible.
- Spot-herbicide invasive species in kettles (i.e. cool season grasses, reed canary grass, and Canada thistle), as needed.
- Conduct a prescribed burn during at least two of the first five years of management.

Long-term Maintenance

- Monitor and maintain restored areas through prescribed burning and spot herbiciding, as needed.



Performance Goals

The following performance goals shall be met by the end of the short-term maintenance period (i.e. by the fifth year of restoration and management).

- Non-native woody vegetation shall not exceed 10% of the total cover.
- At least 80% of the installed herbaceous species shall be present, and at least 60% of the total ground cover shall be native species. This performance cannot be guaranteed in kettles and low areas used for stormwater management without necessary hydrology information prior to planting.

Stormwater Management Areas

Objective

Restore appropriate prairie vegetation in roadside and side-yard conveyance swales and retention basins constructed for stormwater management, as well as in low areas and kettles used for conveyance and retention (also see Wet-mesic Prairie Restoration). The objective of this system is to route and treat surface water on-site in order to maximize the quality and quantity of groundwater infiltration.

Strategy

Route all stormwater runoff through naturally vegetated swales and into low areas on the site (i.e. kettles). All stormwater management areas, except for roadside swales, will be vegetated by native prairie and wetland species in order to allow for maximum biofiltration and infiltration.

The following tasks are needed to restore appropriate prairie vegetation to stormwater management on the site.

1. Roadside swales will be planted to a salt-tolerant grass mix that will have a biofilter function and can be mowed (See Sheet 6).
2. Side-yard conveyance swales will be planted to salt-tolerant, wet-mesic prairie in the swale bottoms and on the slopes (See Sheet 6).
3. All depressions and kettle basins receiving a substantial amount of stormwater will be planted with wet-mesic prairie species. (See Wet-mesic Prairie Restoration and Sheet 6).
4. A detention basin/biofilter in Outlot E will be planted to wet prairie.
5. All kettle sodium buffer areas will be planted with prairie species (dry, mesic, and wet). All buffer plantings will meet or exceed the sodium buffer size requirements found in the Sodium Buffer Plan (See Sheet 5).

Monitoring and Short-term Maintenance

Short-term maintenance of a restoration site is typically considered to be the first five years of restoration and management. All restoration tasks are usually completed and management begins during this time period.

- Monitor restored areas. An AES ecologist shall visit and assess all restored areas twice during each growing season.
- Spot-herbicide invasive species in stormwater management areas (i.e. reed canary grass), as needed.



- Conduct a prescribed burn during at least two of the first five years of management.

Long-term Maintenance

- Monitor and maintain restored areas through prescribed burning and spot herbiciding, as needed.

Performance Goals

The following performance goals shall be met by the end of the short-term maintenance period (i.e. by the fifth year of restoration and management).

- Invasive non-native vegetation (i.e. reed canary grass) shall not exceed 20% of the total cover.
- At least 80% of the installed herbaceous species shall be present, and at least 60% of the total ground cover shall be native species. This performance cannot be guaranteed in stormwater management area (i.e. kettles and detention basins) without necessary hydrology information prior to planting.

Wetland (Sedge Meadow) Restoration

Objective

Restore historic sedge meadow to the extent possible.

Strategy

This will be achieved by restoring hydrology, if necessary and possible, reducing invasive non-native species cover (i.e. reed canary grass), allowing the reestablishment of native species by facilitating a seed bank response, and enhancing native species cover and diversity through seeding and planting.

Tasks

The following tasks are needed to restore the sedge meadow on the site.

1. Locate and disable tiles to restore historic hydrology.
 - Potential affects of disabling tiles on hydrology of neighboring property (i.e. flooding) must be investigated first.
2. Conduct a prescribed burn in degraded sedge meadow.
3. Monitor and evaluate response of native seed bank to burn.
4. Herbicide as appropriate (one or two times), most likely with grass selective herbicide (i.e. Poast).
5. Enhance with native wetland sedges, grasses (i.e. tussock sedge and blue joint grass), and forbs.
 - See Sedge Meadow Restoration species list on Sheet 2.



Monitoring and Short-term Maintenance

Short-term maintenance of a restoration site is typically considered to be the first five years of restoration and management.

All restoration tasks are usually completed and management begins during this time period.

- Monitor restored areas. An AES ecologist shall visit and assess all restored areas twice during each growing season.
- Spot-herbicide invasive species in sedge meadow (i.e. reed canary grass), as needed.
- Conduct a prescribed burn during at least two of the first five years of management.

Long-term Maintenance

- Monitor and maintain restored areas through prescribed burning and spot herbiciding, as needed.

Performance Goals

The following performance goals shall be met by the end of the short-term maintenance period (i.e. by the fifth year of restoration and management).

- Invasive non-native vegetation (i.e. reed canary grass) shall not exceed 20% of the total cover.
- At least 80% of the installed herbaceous species shall be present, and at least 60% of the total ground cover shall be native species.



Figure 1. Site Location Map

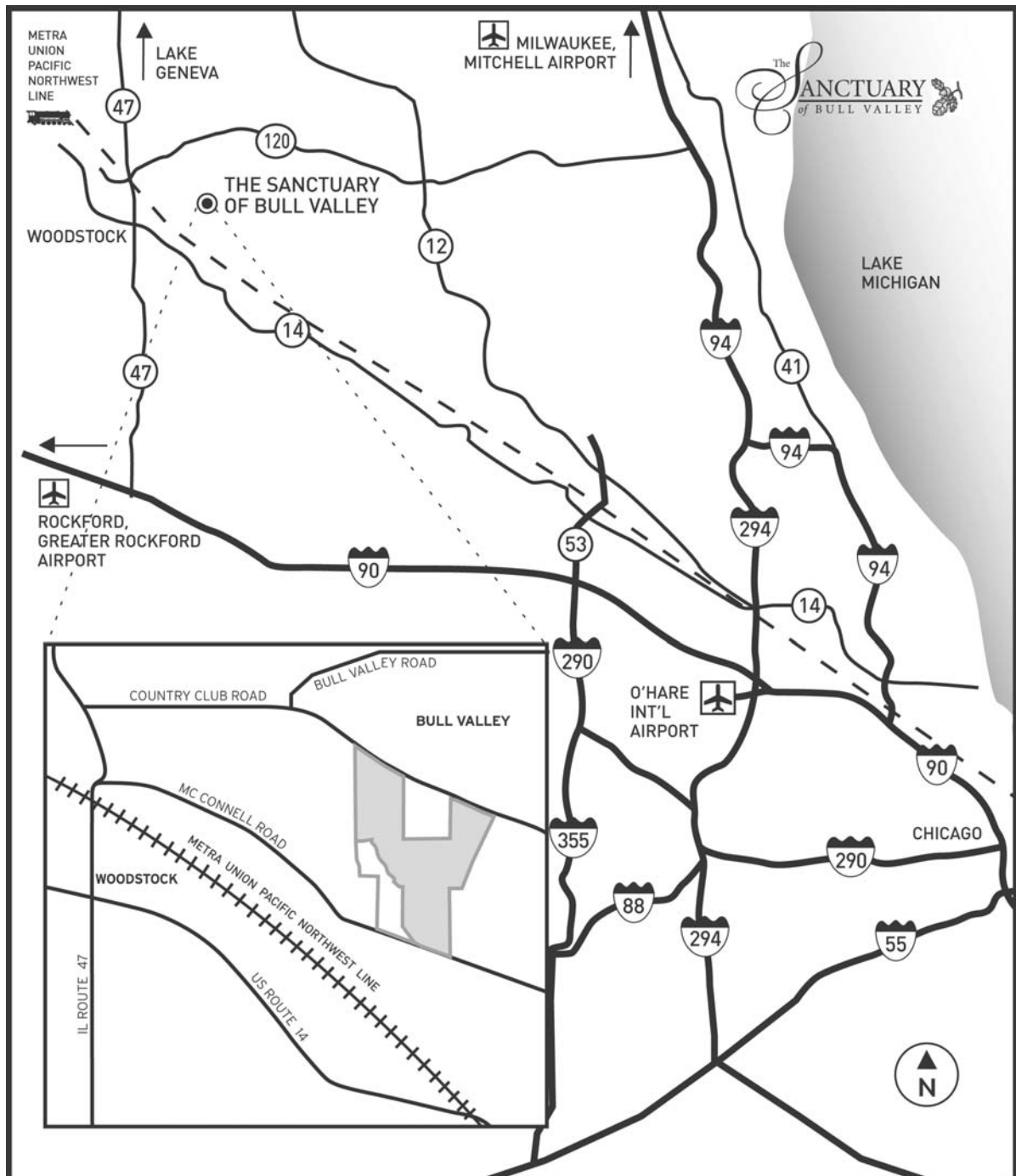


Figure 2. Pre-settlement of The Sanctuary of Bull Valley

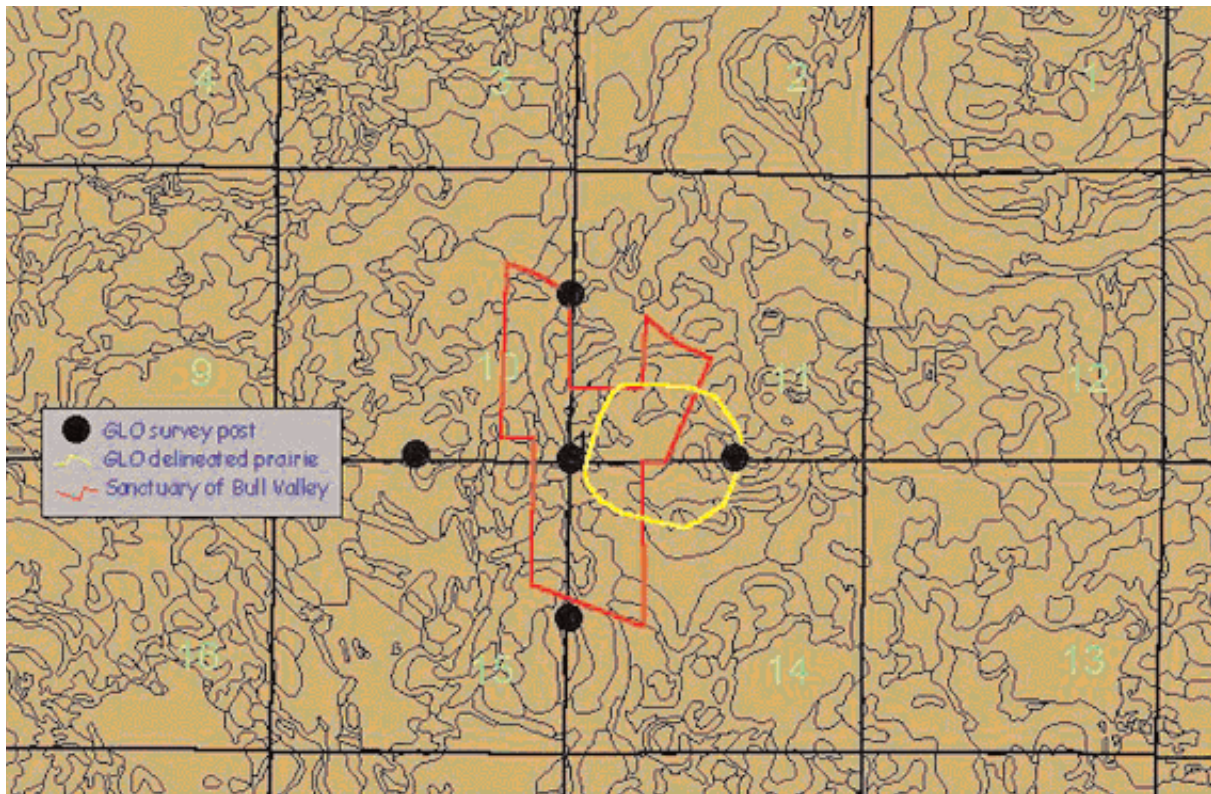


Figure 3. Existing land cover

