# Understanding the Site and Water Section of Version 3.1 of the B3 Sustainable Building Guidelines

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November 5, 2018

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#### Agenda

- Background on B3 revisions and timeline
- Approach and intent of Site and Water Guidelines
- Guidelines (required only):
  - o S.1 Site and Water Connections
  - o S.2 Site Water Quality and Efficiency
  - o S.3 Soil
  - o S.4 Vegetation
  - o S.5 Animal Habitat Support
- Questions



#### Learning Objectives

As noted in the email

- Intent and background behind the changes in the Site and Water Section
- Intent of the Site and Water Connections, Site Water Quality, Soil, Vegetation, and Animal Habitat Support requirements
- Tools used and evaluations performed to meet the new guidelines
- Methods of documenting compliance for version 3.1 of the B3 Guidelines



### **B3** Process – providing a feedback loop





## Which works at different scales







Adapted from Bill Reed



#### Intent of Guideline Revisions

- Bring B3 up-to-date with the latest national standards and green rating systems
- Revise performance standards and requirements to reflect the current state of the building industry in Minnesota
- Reduce the administrative burden for project teams
- Improve the sustainable performance of projects in the future





#### **Timeline of Guideline Revisions**

- New Construction projects funded after in 2004 required to use B3
- 1.1, 2.0, 2.1 (version 2.1 was when the tracking Tool replaced the excel workbook)
- Major Renovations were added to projects receiving funding after 2009
- Version 2.2 2013
- Version 3.0 2017
  - Revisions in overall process and in-depth revisions to process management and materials
  - o Goal of streamlining tracking while maximizing positive benefit
- Version 3.1 required for projects signing up for predesign in the tracking tool on or after January 1, 2019. Includes updates to :
  - o Indoor Environmental Quality
  - $\circ$   $\,$  Site and Water  $\,$
- B3 Version 3.2 scheduled for January 1, 2020. Includes updates to:
  - $\circ$   $\;$  Energy and Atmosphere



#### Site and Water Revisions process

The purpose of the new guidelines is to determine, and evaluate, the unique features of each site for development, so that the most appropriate pathway to meeting the sustainable requirements is provided.

The site and water guideline updates are based on the following principles:

- The characteristics of the site should impact the requirements
- Performance metrics that are tuned to the characteristic of a particular site should be used whenever possible to permit the most appropriate pathway to meeting sustainability requirements
- Sites are optimized to their capability
- Reflect the diversity of the ecology and hydrology of Minnesota
- Take advantage of Minnesota's well inventoried and mapped physical characteristics

Some sites will be asked to do more in certain categories, because they can easily do more. Other sites, where it is very difficult to increase the capabilities of the site in certain categories, will be asked to do less. In every case, there will be an improvement in the site, in each of the categories.



#### Guideline development

Initial guideline approaches were developed based on the principles above and brought to focus groups for discussion on applicability, threshold of required performance and feasibility. Comments were solicited on subsequent drafts and incorporated into the final version of the guidelines.





#### Intent

To support the design and maintenance of project sites which restore the ecological integrity of the site by **restoring the local soil and water quality capable of supporting healthy, biodiverse plant, animal, and human communities**. Current development practices on the land can lead to damaging stormwater runoff, degraded water and soil quality, depletion of water, soil, and valuable vegetated areas, and destruction of habitat. These sites are anticipated to reduce water and energy consumption; improve the rate, quantity, and quality of stormwater runoff; and minimize pollutant contributions related to transportation requirements.



#### Objectives:

- To improve the ability of the soil to maintain its biotic and abiotic structure against adverse impacts of development.
- To restore the site's hydrologic cycle in order to improve the soil, vegetative and animal habitats, and to mitigate adverse onsite and downstream water impacts.
- To reduce consumption of potable water and fossil energy with appropriate site design and the use of local vegetative materials.
- To reduce the amounts of toxic materials and salts used on project sites that contribute to air and water pollution.
- To enhance the biodiversity of the site and surrounding networks of flora and fauna.
- To ensure that local native and endangered species have habitats.
- To restore/improve the outdoor environmental quality (OEQ) of the site to enhance occupant productivity, building performance, and community benefits.



#### **Expanded Definition of Project Site**

Defining the Project Site can be accomplished in the following methods:

- Use property lines to determine the project site.
- In the case of a project on a larger campus the project site may be defined to, at a minimum, include the area disturbed as a result of the construction activities of the project. Projects may meet the requirements of the project site by interventions on the larger campus. These interventions must:
  - $\circ$   $\,$  Be on land owned by the same entity as the primary project site.
  - Satisfy the requirements for the primary project site area and consist of a modification performed as part of the project and documented as a permanent change.

Different secondary project sites may be defined as necessary to meet different guidelines.



#### Intent

**GUIDELINES** 

To create sites that are resilient, healthy and sustainable, connections between the surrounding environment and the site through vegetation selection, animal habitats, and connections to human-made systems.





#### The Natural Vegetation of Minnesota at the Time of the Public Land Survey: 1847-1907

This map was adapted by Barbara Coffin of the DNR. Natural Heritage Porgram from *The Original Vegenation of Minnesota*, a compiled in 1930 by F. J. Marschneth from the U. S. Carenz Land Office Sarvey Netses and published in 1974 unter toot accession of M. L. Heinselman of the U. S. Forest Service. It was produced by the Cartography Laboratory of the Department of Geography, University of Minnesota.



#### S.1A: Plant Network Connections

Establish plant selection to reinforce existing plant networks and to support and expand existing conservation, natural and native species networks.

- The greater of either 25% of the project site area excluding the building footprint, or 70% of the project site area excluding the building footprint and code-minimum parking should be planted using native species listed in the class factsheet for the applicable class.
- 2. If the project site is within 10 miles of a Minnesota DNR Scientific and Natural Area (SNA) as defined by the Minnesota Department of Natural Resources (MN DNR), plant selection shall be used to match, connect, and reinforce the conservation area.
- 3. If the project site is within 1 mile of a Scientific and Natural Area (SNA) as defined by the MN DNR, vegetative and plant selections shall be used to connect, reinforce, and replicate the natural area.



#### S.1B: Animal Network Connections

Animal network connections: Include in the project design appropriate habitats, including both food and shelter, of relevant species if the following criteria are met:

- 1. If project is within 10 miles of major bird migratory flyways, nesting habitat, or stopover feeding areas.
- 2. If project site is within 1 mile of an existing or planned animal movement corridor.
- 3. If project site is within 10 miles of a Wildlife Management Area.
- 4. If project site is within 1 mile of the terrestrial habitats of rare, threatened or endangered reptiles / amphibians of Minnesota.
- 5. If project site is within 1 mile of the habitats of rare, threatened or endangered insects / arthropods of Minnesota.
- 6. If project site is adjacent to the aquatic habitat of rare, threatened or endangered fish of Minnesota.
- 7. If project site is within 1 mile of known important bird habitats and nesting areas of rare, threatened or endangered birds of Minnesota.
- 8. If project site is within 10 miles of a National Wildlife Refuge or National Wetland Management District.



#### S.1C: Human System Connections

Human system connections: The design of project should include appropriate connections to any of the relevant systems in response to the following criteria:

- 1. If project is within 1 mile of an existing or planned bike path, local government officials should be consulted to assist in the creation of a bike connections between site and existing routes.
- 2. If project is within 1 mile of an existing or planned walking path, local governmental officials should be consulted to assist in the creation of a safe walking connection between site and existing routes.
- 3. If project is within 1 mile of an existing or planned future MN DNR water trail, local governmental officials should be consulted to assist in the creation of a connection to existing or future water trails.
- 4. If project is within 1 mile of an existing or planned birding trail, county and governmental officials should be consulted to assist in the creation of a connection to existing or future planned MN DNR or MN Audubon birding trails.
- 5. If the project is within .25 miles of an existing or planned transit stop, local transit officials should be consulted assist in the creation of a pedestrian path and waiting shelter at the stop (if none exist).



#### S.1 Submittal Requirements Overview

- S.1A: List of vegetation selected demonstrating compliance, including the class fact sheet; narrative on the project response to native and conservation areas; list of species selected from the class factsheets for site and area of site planted with listed species.
- S.1B: Final site plan documenting animal habitat as required.
- S.1C: Final site plan documenting required human network connections.



#### Intent

To restore the natural water cycle of Minnesota biomes in order to support natural hydrology, soils, vegetation and animals, reduce and limit the amount of chemicals and soil leaving the site, reduce the potable water usage, and to respond to the ecological factors of the project site within the larger watershed.





**GUIDELINES** 

#### Major threats to groundwater



Nitrate — One of the most common water pollutants in Minnesota groundwater, affecting a large number of private wells and public water supplies. Elevated nitrate in drinking water can be harmful to human health, specifically to the health of infants. Septic systems, fertilizers, and manure are major sources of nitrate pollution in Minnesota.



**Road salt** — The salt applied to roads, parking lots, and sidewalks during our icy winters contains chloride, a water pollutant.

#### S.2A: Stormwater Quantity and Watershed Connections

Water leaving the project site is subject to the following:

 Site Water Cycle Requirements: The project site shall manage stormwater to meet the required percentage of precipitation resulting in site infiltration, evapotranspiration, and runoff according to its soil types, based on the evaluated annually using the MIDS calculator. Additional requirements for A and B soils located in the uplands and lowlands of the watershed are listed under part 2 below:

Hydrological Soil Groups	Infiltration at Least	Evapotranspiration at least	On-Site Reuse	Runoff Not to Exceed	Total Onsite Managed
A Soils: 1.63–0.8 inches/hour	100%	0%	0%	0%	100%
B Soils: 0.45–0.3 inches/hour	50%	40%	5%	5%	95%
C Soils: 0.2 inches/hour	30%	55%	7%	8%	92%
D Soils: 0.006 inches/hour	5%	60%	25%	10%	90%



#### S.2A: Stormwater Quantity and Watershed Connections (cont.)

- 2. Watershed connections: (Note that if the project is within a watershed district or management organization's jurisdiction there may be other requirements for the site not listed here).
  - i. For projects located in the uplands of the watershed and in Hydrologic Soil Group A: High Infiltration or Hydrologic Soil Group B: Moderate Infiltration, infiltration of all rainfall events should be planned for a 25-year, 24-hour rain event for project area.
  - For projects located in the lowlands and Hydrologic Soil Group A: High Infiltration or Hydrologic Soil Group B: Moderate Infiltration, infiltration of all rainfall events should be planned for up to the 10year, 24-hour rain event for project area.
  - iii. The features of the site's location in the watershed or lakeshed and any site-watershed features should be used to inform the design of the site.



#### S.2A: Stormwater Quantity and Watershed Connections (cont.)

- 3. Flood prevention: If required by building program to construct within a flood plain, the project shall follow the Federal Emergency Management Agency's (FEMA) regulatory flood protection elevation requirements. Building in a floodplain is prohibited unless essential to the program of the project.
- 4. Runoff Rate: The site shall be designed to not exceed the pre-settlement runoff rate for native soil and vegetation conditions, as evaluated by achieving compliant curve numbers (CN) per NRCS TR-55 below those of the pre-settlement condition.

TR 55 PEAK RUNG	OFF CALCU	JLATION	(GRAP	HICAL N	NETHO	D)	ver 12-2010	
CLIENT: DSN BY: COMMENTS:		COUNTY: CHK BY:	ADAMS			DATE: DATE:		
Drainage Area Runoff Curve Number NO DATA IN	0 0 I RCN TABLE!	Acres		Clear Data Entry Cells	GO TO Te DATA	GO TO RCN DATA	HELP	
Time of Concentration	0.000	Hours			PRINT RUNOFF TABLE	PRINT Tc TABLE	PRINT RCN DATA	
Frequency	yr	1	2	5	10	25	50	100
Rainfall, P (24 hour) Initial Abstraction, Ia Ia/P ratio	in in	2.4	2.8	3.6	4.1	4.7	5.2	5.9
Unit Peak Discharge, qu Runoff	cfs/ac/in in ac-ft							
Peak Discharge, qp	cfs							

#### S.2B Stormwater Quality

- Provide treatment systems designed to remove 80% of the post-development Total Suspended Solids (TSS) and designed to remove 60% of the post-development Total Phosphorus (TP). The design of the retention of Total Suspended Solids and Total Phosphorous shall be accomplished with best management practices and calculated using the MIDS calculator.
- 2. The reduction of the chlorides shall be accomplished by:
  - i. Reducing the area of on-grade impervious surfaces requiring chlorides by 20%.
  - ii. Reducing the amount of chlorides on the remaining impervious surfaces by employing the MPCA Winter Maintenance Assessment Tool as operational practice.
  - iii. Developing a chloride management plan for site operations to ensure ongoing chloride-use limits.



#### S.2C: Outdoor Water Efficiency

No potable water shall be used for irrigation after a 5-year plant establishment period except for periods when actual rainfall for the month is less than 30% of the average rainfall for that month. Collected Roof Rainwater and Graywater may be used for plant irrigation at any time. Turf grass integral to the program of the site, such as athletic fields or school recreational fields are excluded from the calculation for this requirement.



#### S.2D: Indoor Water Efficiency

Municipal potable water or harvested groundwater use in building shall be reduced by 50% compared to a baseline established on the 1992 Energy Policy Act requirements and including water-consuming appliances for all uses associated with fixture types referenced by those requirements. The criteria may be met by any combination of the following: selection of low or no-flow fixtures, use of recycled rainwater, or other strategies.

- 1. Renovation portions of projects may limit performance criteria application to the number of fixtures included in the renovation scope subject to the following exemption:
  - i. Faucets in the renovated area shall be upgraded with low-flow faucet aerators, and showerheads shall be upgraded with low-flow showerheads even if other plumbing fixtures are not upgraded.
- 2. Recycled rainwater can also be used to offset the percentage of potable water usage if allowed in the local jurisdiction.
- 3. To verify compliance with this guideline during operation of building, it is necessary to sub-meter indoor water consumption separately from irrigation.



#### S.2 Submittal Requirements Overview

- S.2A: Submit the requirements for infiltration, evapotranspiration, and runoff derived from referencing the ATLAS-14 storm events and documentation of relevant project location in the watershed and soil group(s) and the site's flood plain designation.
- S.2B: Upload the completed MIDS model demonstrating intended removal systems for required TSS and Phosphorus reductions.
- S.2C: Submit verification that all plant materials are either drought tolerant or can live without potable water after plant establishment period.
- S.2D: Submit base and design case indoor water consumption, any alternatively sourced indoor water used.



#### Intent

To ensure the maintenance and restoration of healthy soils by documenting existing soil conditions, preserving and protecting benefits of existing soil, minimizing the impacts of construction, repairing soils to return to supportive conditions, and documenting soil maintenance practice s to ensure ongoing optimal soil conditions.







#### S.3A Soil Survey

The soil conditions on project site shall reference data from the NRCS Web Soil Survey (websoilsurvey.nrcs.usda.gov) and shall be described. This description must include:

- 1. A Site Soil Inventory Map (SSIM).
- 2. A listing of which of the eight soil orders, 1,000 soil series, and seven slope classes that occur in Minnesota are present on the subject site based on the NRCS Web Soil Survey.
- 3. A listing of any soil limiting constraints for organic, wetland, or expansive clay soil's (shrink/swell) for the proposed project site uses.
- 4. A listing of which of the three stages (as defined by this B3 Guideline) currently apply to the state of the project site's soils: "Natural," "Agricultural," or "Urban."
- 5. A determination of whether the project is considered a "Greenfield" (see definition below).
- 6. A listing of specialized MnDNR defined Native Plant Communities (NPC).
- 7. A mapping of any naturally occurring Atypical soils (see definition below)
- 8. Results from soil testing.



#### S.3B Greenfield Site Rational

For projects developing on a greenfield site, the following should be submitted:

- 1. A written rationale of the need to develop a Greenfield site rather than a previously developed site.
- 2. A plan for minimizing the disruption of existing, native, noninvasive vegetation.



#### S.3C Limit Soil Disturbance

Soil disturbance defined as grading, compacting, piling, tilling, scraping, storing, should be limited and the removal of soil within natural and agricultural human soil development spectrum areas should be ensured by the following and included in the Stormwater Pollution Protection Plan (SWPPP) for the project:

- 1. Protecting intact soil with intact soil horizons using Site Soil Protection Zones (SSPZ); delineating exclusion barriers for these areas to ensure soil protection during construction.
- 2. Soil in the following areas should not be disturbed:
  - i. Forty feet beyond the building perimeter.
  - ii. Fifteen feet beyond the primary roadway curbs, parking lots, main utility branch trenches, or impervious areas.
  - iii. Five feet beyond walkways.
  - iv. Any area under or closer than 1 foot of tree driplines per 1 inch of DBH trunk diameter e.g. 12 inch DBH will require tree protection fence at least 12 feet from the trunk.
  - v. Areas within any identified stormwater management features.
  - vi. Retaining walls within these areas may be employed as needed to maintain necessary grades.
- 3. Trees shall be protected as individuals with the tree protection fence located outside the drip line, as defined above in C.2.iv, prior to site activities. Trees may be protected as groups if their canopies are within 10 feet of each other, with tree fence protection zone distances as defined above in C.2.iv.



#### S.3D: Soil Management and Erosion Control Plans

Soil management and erosion control plans should be created and implemented to protect the soil profile of the current site before, during, and after construction.

#### S.3E: Bulk Density Limits

The bulk density of all unpaved pervious surfaces intended for seeding and planting shall have the following maximum bulk densities:

- 1. Clays and Silts: 1.25 g/cm3
- 2. Loams: 1.40 g/cm3
- 3. Sands: 1.60 g/cm3



#### S.3F Watershed Buffer

A 50-foot minimum of perennially rooted vegetated buffer for delineated wetland boundaries shall be maintained, established, or enhanced.

#### S.3G: Topsoil Retention

Topsoil from project site shall not be sold or exported, until all landscaped areas (tree, shrub, perennial, annual or lawn plantings) have received an average 12 inch deep respread using soil from the project site. Existing site topsoil shall be stockpiled and protected, or topsoil should be imported for an average respread depth of 12 inches in all proposed planting and seeding areas. No topsoil should be screened with less than a 3-inch screen.



#### S.3H Organic Material Minimums

At least 3.5% organic material by soil weight should be achieved in planting and seeding areas by adding sufficient organic matter to soil below this threshold.

#### S.3I: Urban Soil Requirements

If urban soils are present, in-site landscaped areas soil should be amended to mimic the physical and biological capabilities of natural and agricultural soils to achieve the following metrics:

- 1. Soil texture: determine which of the 12 soil classes are present on the site.
- 2. A pH between 4.5 and 8.5.
- 3. NPK Fertility greater than medium
- 4. Meeting the following bulk density requirements for the listed soil types:
  - i. Organics: less than 1.0 g/cm<sup>3</sup>
  - ii. Clays: less than 1.25 g/cm<sup>3</sup>
  - iii. Loams: less than 1.4 g/cm<sup>3</sup>
  - iv. Silts: less than 1.25 g/cm<sup>3</sup>
  - v. Sands: less than 1.6 g/cm<sup>3</sup>



### S.3I: Urban Soil Requirements (cont.)

- 5. Organic matter content should achieve a minimum of 3.5% by weight through the incorporation of Class A Biosolids, U.S. Compost Council Certified Compost, and activated biochar (as defined in this B3 Guideline) in the following depths for the following soils:
  - i. Pre-development: incorporated (e.g. V-ripper or Paraplow) into site soils to a minimum depth of 24 inches.
  - ii. Post-development: incorporated (e.g. V-ripper or Paraplow) into site soils to a minimum depth of 12 inches.
  - iii. Minor Modification Amendments: applied as topdressing or incorporated into site soils to a minimum 6-inch depth.
- 6. Soil should be modified to achieve the following NRCS infiltration rate for the following conditions:
  - i. Natural stage soils improved to have a higher infiltration rate than Group A.
  - ii. Agricultural stage soils improved to have a higher infiltration rate than Group B.
  - iii. Urban stage soils improved to have a higher infiltration rate than Group C.
  - iv. Stormwater infiltration stage soils improved to have a higher infiltration rate than Group A.
- 7. A cation exchange capacity (CEC) of at least 15 should be achieved.
- 8. A base saturation percentage of at least 30% should be achieved.
- 9. A mycorrhizae count of at least two Glomus species per ounce of soil should be achieved.



#### S.3J: Atypical Soils Requirements

Atypical soils: If the project has atypical soils or substrates for a specialized native plant community (NPC) these shall be preserved according to the following:

- All naturally occurring Atypical soils of an area greater than 5,000 square feet shall be preserved as required to support NPC in seeps, fens, bogs, bedrock outcrops, sand blow-outs and sand dunes (as defined by MnDNR Natural Heritage and Nongame Research Program), Spodosols, Histosols, Psamment Entosols, Sodic soils.
- 2. The boundaries of these atypical soils and substrates should be field mapped, marked, and delineated with visible flagging on project site. This NPC delineation prohibits entry of any vehicles with tires before, during, or post construction. These soils or substrates should not be disturbed, buried, blasted, or removed from their original location on site.



#### S.3J: Atypical Soils Requirements (cont.)

- 3. Minnesota Biological Survey staff of the MN DNR should be consulted to create and execute the following:
  - i. A specialized, NPC planting plan with a conservation status rank (S-ranks) of S1 or S2, that most appropriately matches the site's atypical soils and substrates.
  - Guidance on site preparation (weed and erosion control), site drainage, and revegetation (seeding, planting, etc.), and long-term maintenance (fire management, weed control, etc.) for that specialized NPC.
  - iii. Operations and maintenance plan to ensure that this restored vegetation and naturally occurring atypical soil is rigorously protected and maintained.
- 4. Upon complete installation of this specialized NPC, a perimeter exclusion fence should be installed with one permanent, outdoor sign (dimensions at least 24 by 36 inches) interpreting the specialized NPC using Tilden's 5 Principles of Interpretation.



#### S.3 Submittal Requirements Overview

- S.3A: Submit description of site soils per guideline.
- S.3B: If project is developing on a greenfield site, submit rationale for developing on site and a site plan documenting minimization of the disruption of existing, native, non-invasive vegetation.
- S.3C: Submit site plan delineating limits of soil disturbance during development, including Site Soil Protection Zones (SSPZ).
- S.3E: Submit Contract Documents section with specifications for bulk density requirements for all unpaved pervious surfaces.
- S.3F: If wetlands are present on site, submit site plan noting 50-foot vegetated buffer for delineated wetland boundaries.
- S.3G: Submit Contract Documents section, which prohibits selling or exporting any topsoil from project site, and delineate onsite plan storage areas for site's topsoil that will be reused.
- S.3H: Submit Contract Documents section specifying that the soil must have a minimum of 3.5% organic material by soil weight.



#### S.3 Submittal Requirements Overview (cont.)

- S.3I: Urban Soil Restoration Amendment Plan of future landscaped area in 1,000 sf units and Contract Documents section with related specifications.
- S.3J: Submit results of coordination with Minnesota Biological Survey staff for NPC restoration, including planting list, details of site preparation, drainage, and revegetation, signage and O&M manuals.
- S.3I: Soil texture, pH, NPK fertility, bulk density, organic matter, infiltration rate, cation exchange capacity, base saturation, and mycorrhiza count requirements for each 1,000 square feet of site landscape area.



#### Intent

To optimize the ecological function of project sites by restoring Minnesota's native vegetation, protecting natural areas, conserving existing site features, and selecting vibrant and appropriate vegetation to ensure the optimum functioning of ecosystems.





#### S.4A: Avoidance of Critical Sites

Sites should not contain any of the following:

- 1. Prime farmland (as defined by the NRCS Web Soil Survey)
- 2. Farmland of state significance (as defined by the NRCS Web Soil Survey)
- 3. Former municipal, township, or county parkland
- 4. Former federally protected lands
- 5. Areas covered by a conservation easement

Note: On areas under a conservation easement, the only allowed activity is restoration to the original native plant community (NPC), per the MN DNR's County Biological Survey.



The following tree conditions shall be established:

- Combined trunk areas of all trees (including deciduous and coniferous) evaluated at ten-year estimated maturity post-construction and measured by calculating the trunk area at 4.5 feet above the ground (i.e., diameter at breast height or DBH):
  - i. Tall grass aspen parkland and savanna: 3 to 6 square feet of trunk area per acre.
  - ii. Southern and southeastern hardwood deciduous: 7 to 12 square feet of trunk area per acre.
  - iii. Northern deciduous: 5 to 10 square feet of trunk area per acre.
  - iv. Boreal conifers: 8 to 14 square feet of trunk area per acre.



2. Required minimum of tree diameter as evaluated in diameter at breast height (DBH) to trunk area at ten years maturity, and number of large, medium, and small trees needed to achieve this requirement:

Type of Tree Plant Community	Square Feet (144 sq inches per 1 sq ft) Trunk Area	Number of Large Trees Only (0.66 sq ft ea/12 inch DBH)	Number of Medium Trees Only (0.39 sq ft ea/7 inch DBH)	Number of Small Trees Only (0.20 sq ft ea/3 inch DBH)
Prairie	0	0	0	0
Tall Grass Aspen Parkland & Prairie Savanna	2-4	3-6	5-11	10-20
South & Southeast Hardwood Deciduous	4-7	6-11	11-18	20-35
Northern Deciduous	3-6	5-10	8-16	15-30
Boreal Coniferous	4-7	6-11	11-18	20-35

Type of tree plant community shall be established based on the MN DNR Ecological Provinces Map.



- i. Adequate tree soil volumes should be achieved: Where trees are surrounded by hard surfaces (e.g., sidewalks, patios, driveways, car parks, plazas, parking islands), suspended pavement techniques, structural soils, or other comparable methods such as larger tree openings to provide adequate rootable soil volumes should be used. Minimum volume of rootable soil volume per tree is:
  - (1) Small trees (e.g., Serviceberry Amelanchier): 400 cubic feet.
  - (2) Medium trees (e.g., Ironwood Ostyra): 800 cubic feet.
  - (3) Large trees (e.g., Hackberry Celtis): 1,200 cubic feet.

If using structural soils multiply the total soil volumes above by five to obtain equivalent volume of soil useable by the tree. If above soil volumes cannot be met, trees species requiring smaller soil volumes should be selected. Where applicable, suspended pavement or comparable methods should be utilized to allow tree roots under hard surfaces to access adjacent open space.



- ii. Adequate tree diversity should be achieved to limit susceptibility of site to disease and increase ecological resilience: Tree genera of like form in should be planted in large single species tree plantings, such as allees or formal groupings. The following numbers of tree generas should be achieved:
  - (1) Three genera on sites of fewer than two acres.
  - (2) Five genera or more on sites of two to five acres.
  - (3) Seven genera or more on sites of five to ten acres.
  - (4) Nine genera or more on sites of ten to 15 acres.
  - (5) Twelve genera or more on sites of 15 to 20 acres.
  - (6) Fifteen genera or more on sites of 20 to 40 acres.
  - (7) Eighteen genera or more on sites of 40 to 100 acres.
  - (8) Twenty genera or more for sites of greater than 100 acres.



#### S.4A: Tree Area and Planting Provisions (cont.)

- 3. Tree planting requirements: at time of tree planting the following criteria should be met:
  - i. All soil/mulch/media covering trunk flare removed.
  - ii. Point of stem/root union exposed at original ground surface elevation (see UofMN Extension).
  - iii. Caliper size of all trees limited to 2 1/2 inches at planting.
  - iv. All stem girdling roots (SGR) on trees rejected or removed (see UofMN Extension).
  - v. Metal baskets and burlap removed from B&B root balls to 12 inches below soil level.
  - vi. Trees should not be planted deep in the planting hole to stabilize them.
  - vii. Mulch should not be placed against tree trunk deeper than 1 inch deep; tree stem/root union should be planted one to three inches higher than surrounding ground plane elevation.
  - viii. Newly planted trees should be watered at a rate of 1.5 gallons per caliper inch per 3 calendar days from May through September, at the following intervals. Watering bags are recommended.
    - (1) Year 1: At least every 3 days
    - (2) Year 2: At least weekly
    - (3) Year 3: At least every 2 weeks

See Soil section for acceptable drainage and bulk density rates for soils in planting areas.



- ix. Crowns should not be pruned at planting to balance root and crown volumes.
- x. Broken branches should be pruned and removed to develop a single central leader. Codominant branches that exceed 1/2 tree trunk diameter at branch/trunk attachment point should be removed.
- xi. Trees in containers that are root bound should be box cut.

The following should be evaluated and implemented if feasible:

- xii. Contracting growing trees for orders exceeding 20 trees total.
- xiii. Growing bare root stock in Missouri gravel bed nursery for half the growing season prior to planting out to create a large vigorous tree root system.
- xiv. Using arborist's wood chip mulch to a depth of up to six inches deep, over tree root systems but not against trunks. If trees are unstable in their planting hole reject trees or require one year of tree staking.
- xv. Grade all landscaped areas to slope towards tree plantings.



#### S.4C: Vegetation Selection

The vegetation selected shall be subject to the following and selected in coordination with the animal and vegetation requirements listed under S.1 and animal habitat requirements listed under S.5:

- 1. Existing, noninvasive, nonnative vegetation should not be removed solely in order to achieve the amount of native vegetation required under S.1A.
- The selection of herbaceous plantings for prairies, wetlands, savannas, parklands, and forests shall use the methodology (Steps 1–5) found in MN-DOT's Native Seed Mix Design for Roadsides (2014): www.dot.state.mn.us/environment/erosion/pdf/native-seed-mix-dm.pdf.
- 3. The required strata are a ground layer less than 48 inches tall and a tree canopy greater than 78 inches tall.



#### S.4C: Vegetation Selection (cont.)

- 4. Keystone species shall be selected according to the following restoration goals:
  - i. Where savanna, south and southeastern hardwood deciduous and northern deciduous are being restored, one of the selected trees in the cohort population shall be included: Burr Oak.
  - ii. Where prairie and savanna are being restored, one of the selected trees in the cohort population should be included: American Hazelnut or Beaked Hazelnut.
  - iii. Where prairie, tall grass aspen parkland, and savanna are being restored, two of the selected grasses in cohort population should be included: dry/xeric grasses and side oats gramma; medium/mesic grasses – big bluestem and Indian grass; wet/hydric grasses – switch grass and prairie cord grass.
  - iv. Where south and southeastern deciduous hardwood and northern deciduous and boreal conifers are being restored, one of the selected trees in the cohort population should be included: Serviceberry.
  - v. Where boreal conifers are being restored, one of the selected trees in the cohort population should be included: White Pine.



#### S.4C: Vegetation Selection (cont.)

- 5. The coefficient of conservancy for all B3 sites with wetland hydrology at planting must be greater than four (4) as calculated by the floristic quality assessment (FQA) method (per Wilhelm 1977). In areas adjacent to water bodies or wetlands or rivers or streams, a series of exploratory holes twelve inches deep should be dug between April and November. If water appears and persists in the hole for more than two hours after excavation, a FQA must be performed.
- 6. Invasive species on site should be determined using the *Invasive Species County Weed Guideline*. If the site does contain invasive species, a mitigation and maintenance plan as defined by the Minnesota Department of Agriculture should be created or implemented.
- 7. All vegetation must be selected in accordance with the correct local USDA hardiness zones.



#### S.4D: Pollinator Friendly Vegetation

Pollinator friendly vegetation:

- Neonicotinoid-free sites: All project plantings must use a written chain of custody method to verify Neonicotinoidfree claims. Reject plants that have been neonicotinoid treated, or do not have a clear, verifiable chain of custody of being neonicotinoid-free. This requirement also applies to trees, shrubs and vines.
- 2. Site plantings should be selected so that at least 50% by quantity of all trees, shrubs, groundcovers, vines, and herbaceous perennials are insect pollinated, and rich in pollen and/or nectar.
- 3. Blooming pollinator plants should be provided for all three seasons of blooms (spring, summer, fall), with at least two different species blooming during each season.
- 4. Coincidently blooming pollinator plants should be clustered in large groupings to reduce expended energy of insect pollinators.
- 5. Abundant human and natural structural enhancements should be provided for insect pollinators (e.g., dead tree snags, downed tree logs, sand baths, bee skeps, solitary beehives, mason bee houses, green roofs, and green walls).
- 6. Cultivars with double and triple petal flowers that do not produce pollen or nectar should be minimized.



#### S.4E: Biomass Target

Achieve biomass target according to major ecosystem of site, as measured in biomass per area of vegetated site area, estimated at ten years post-occupancy according to the major ecosystem characterization from MN DNR:

- 1. Prairie: 1.1 kg/per square meter or 2.03 pounds/per square yard.
- 2. Tall-grass aspen parkland and savanna: 0.9 kg/per square meter or 1.66 pounds/per square yard.
- 3. South and southeastern hardwood deciduous forest: 0.7 kg/per square meter or 1.29 pounds/per square yard.
- 4. Northern deciduous and boreal conifer: 0.6 kg/per square meter or 1.11 pounds/per square yard. These biomass targets do not apply to the restoration of specialized native plant communities (NPC) installed pursuant to S.3K: Atypical Soils.



#### S.4F: Site Albedo Limit

Site should be designed so that the entire site albedo is at least 0.25 as evaluated using the B3 Albedo Calculator.



#### S.4 Submittal Requirements Overview

- S.4A: Identification of any critical site conditions.
- S.4B: Verification of language mandating compliance in construction documents for tree trunk areas, tree soil volumes, tree soil diversity and specifications outlining tree planting methods
- S.4C: Verification of compliance method in construction documents for all required vegetation conditions, including planting plan for each plant category identified in the Predesign matrix for genera, species, and structural diversity of planting guidelines, updated from prior iterations.
- S.4D: Verification of selection of pollinator friendly plantings and specifications prohibiting using neonicotinoid products during the establishment, maintenance and operation of the site.
- S.4E Identification of major ecosystem and construction documents requiring compliance with biomass target.
- S.4F: Completed Appendix S-4 Albedo Calculator demonstrating compliance with albedo limits. A site plan showing the location and size of areas with different reflective characteristics and their assigned albedo values should be included.



#### Intent

To protect and support site animal habitat resilience by reducing negative impact of the built environment on animal species and provide supportive environments for at-risk native species that are essential to ecosystem health.





#### S.5A Whole Building Threat Factor (Bird Safety)

The Whole Building Threat factor (WBTF) must be less than or equal to WBTF 45 for sites not designated as "critical." The WBTF must be less than or equal to 15 for critical sites. The Whole Building Threat Factor is calculated through the B3 Guidelines Bird-Safe Design Calculator (Appendix S-5a). This calculator will also assist in determining compliance with S.5B, S.5C, S.5D, and S.5I (if pursuing).

#### S.5B Non-Enclosure Threat Factor

The Non-Enclosure Threat Factor (NETF) must be less than or equal to 45. Use the B3 Guidelines Bird-Safe Design Calculator to determine NETF for non-enclosure surfaces.



#### S.5C: High Risk Surfaces

The portion of the building considered a High Risk Surface may not include more than 15% of its surface area of a material with a threat factor of 75 or greater.

#### S.5D: Traps

No portion of the building considered a "trap" may include any glazing with a threat factor (TF) greater than 25: For the purposes of these guidelines, the following conditions are considered traps:

- 1. Transparent exterior railings, where all surfaces are exposed to exterior.
- 2. Transparent-sided walkways (e.g., skyways, covered walks with glass on two sides).
- 3. Any condition that offers a view from exterior to exterior that is 20 feet or fewer across, such as a small atrium or glazed corners.



#### S.5E: Lights Out Management

Follow the Lights Out light management program, which addresses operation of lights at night for specified times and dates of bird migrations. Note that this procedure is also required by law for state owned and managed buildings. The program advises to turn off building lighting including but not limited to architectural lighting at top of building; uplighting; interior lighting, especially on upper floors; and lobby or atrium lighting during times and dates listed below.

- 1. Dates: between March 15 and May 31 and between August 15 and October 31 each year.
- 2. Times: between midnight and dawn.
- 3. Exception: lights that have been documented as necessary for normal use of the building between midnight and dawn may be operated.



#### S.5F: First Year Monitoring

For one year after construction/occupancy, the perimeter of the building(s) should be walked and all accessible setbacks and roof areas observed at least two times per week. Activity and findings should be surveyed and documented as listed in Appendix S-5b Bird Safe Monitoring Worksheets.



#### S.5G: Protection of Rare, Threatened or Endangered Species

If the project site is within 2 miles of a Minnesota state rare, threatened, or endangered species, the project team must create and execute a Minnesota state rare, threatened, or endangered species protection plan for those species on the project site, in coordination with MBS staff at the MN DNR. This shall include the following:

- 1. A perimeter exclusion fence a minimum of 42 inches tall.
- 2. A permanent outdoor interpretive sign of dimensions greater than 24 inches by 36 inches that references the site's identified rare, threatened, or endangered species, using Tilden's 5 Principles of Interpretation.
- 3. An operation and maintenance (O&M) manual to vigorously protect with instructions on how to enhance the vigor of the subject species until delisting.
- 4. Supportive habitat for the noted species, aggregated into largest single units with least perimeter.
- 5. Management practices for the subject site designed to protect and enhance the viability of rare, threatened, or endangered species until that species is delisted. Requirements may include avoidance, buffers, management with fire, elimination of fertilizers and invasive species, and/or artificial drainage.



#### S.5H: Animal Habitat Provisions

The following provisions for animal habitat should be included in design:

- 1. Water features with the following characteristics are required for all B3 sites subject to the listed exclusions:
  - i. Open year-round (for example an aerator may be required to ensure that at least 10% of the water feature is accessible year-round).
  - ii. Gently sloped (<10% grade) access for five feet horizontal distance.
  - iii. Limit ledges and sharp drop-offs.
  - iv. Primary water source should be roof-collected rainwater, supplemented by treated greywater and potable water as necessary to maintain water feature.
  - v. Water features are not required for sites within 500 ft. of an existing natural water body of at least 1 acre in size or a stream at least 10 ft. in width.



vi. Size requirements as follows, for listed non-building area:

Size of Site	Size of Water Feature in ft <sup>2</sup>	Maximum Depth of Feature in inches	Size of Feature of Under 2" Depth in ft <sup>2</sup>	Percent of Perimeter with Gently Sloped (under 10% grade) Access
Less than 1 Acre	100	12	50	50%
1 to 3 Acres	300	12	100	50%
3 to 5 Acres	500	24	200	40%
5 to 10 Acres	2,000	24	200	30%
10 to 20 Acres	8,000	36	1000	30%
20 to 40 Acres	16,000	n/a	2000	30%
More than 40 Acres	15% of site area	n/a	15% of water feature area	20%



- 2. If the project site is either greater than three acres in size or if the site is adjacent to or adjoining a permanent surface water body, natural bat habitat enhancement should be installed and maintained, including implementation of the following:
  - i. Multiple standing snags (>10" DBH) and downed logs in all wooded areas of subject site.
  - ii. Bat boxes to provide roosting area for 80 colony roosting bats per acre of surface water and 40 colony roosting bats per acre of nonsurface water areas.
  - iii. Bat boxes within 100 feet of permanent site water feature, facing south or southeast.
  - iv. During the fifth growing season following project opening, the number of bats on subject site should be observed and recorded. Bat habitat should be remediated if at least 50% of the bat boxes have not been used by at least one species of bat that season.



- 3. Reptile and amphibian habitat and breeding sites should be created with natural and human made structures to achieve at least one amphibian and one reptile by the fifth growing season. Provide acceptable reptile and amphibian enhancement structures on a year round basis, including implementation of the following:
  - i. Natural: standing snags, brush piles, piles of leaf litter, downed log,; haul-out logs in water bodies, large flat sunning stones in full sun, wood and rock mulches, sand and gravel baths on south slopes and in shallow water.
  - ii. Human-made: stone snake or reptile hibernaculum; fabricated buried wood, stone or concrete reptile and amphibian dens; submerged Christmas tree reefs; wooden stream-bank lunkers.
  - iii. Any other reptile and amphibian habitat enhancement structures may be acceptable if they have been listed in peer-reviewed literature and approved by the B3 Guidelines Team.
  - iv. Limiting area of mown lawn to increase available reptile and amphibian habitat.
  - v. Avoiding use of pesticides that harm animals.



- vi. The presence of reptile and amphibians should be verified during the fifth growing season following the project opening and during the monitoring period of March to November, for a period not to exceed 24 hours. A 48-hour bio-blast monitoring protocol is an acceptable methodology. Animals may be captured for monitoring purposes only, but limit time of handling to avoid stressing, injuring, or killing these temporarily captured animals. Remediate reptile and amphibian habitat if at least one reptile and one amphibian have not been observed.
- 4. Insect pollinator habitat should be created so that during the fifth growing season following the project opening, at least one butterfly, one bee, and one other insect pollinator shall be found on site using monitoring protocols per growing season/24-hour search. The site design should be remediated as necessary to achieve if not successful during monitoring.



#### S.5I: Dark Sky

The aggregate illumination level outlined under the most recent International Dark Sky Association Joint IDA IES Model Lighting Ordinance (IDO) should not be exceeded for the project's lighting zone.



#### S.5 Submittal Requirements Overview

- S.5A through S.5D: Bird Safety Metrics as calculated by appendix S.5A
- S.5E: Verification of a Lights Out management program in place.
- S.5F: Verification that the facility operations team is aware of first-year monitoring requirements.
- S.5G: MN DNR, Minnesota Heritage Division, County Biological Survey (CBS) maps, showing the boundary limits of subject site and the surrounding 5-mile distance in miles to nearest Minnesota rare, threatened, or endangered species. If species found that trigger additional guideline requirements submit responsive design and species protection plan for the NPC per guideline requirements.
- S.5H: Preliminary site plan outlining guide requirements, including water feature, bat habitat, Reptile and amphibian habitat, and pollinator habitat.
- S.51: Lighting zone that most represents the surround site conditions of the project site and aggregate illumination level of project design.



### Questions?

