METROPOLITAN NASHVILLE LANDSCAPE GUIDELINES AND BEST MANAGEMENT PRACTICES

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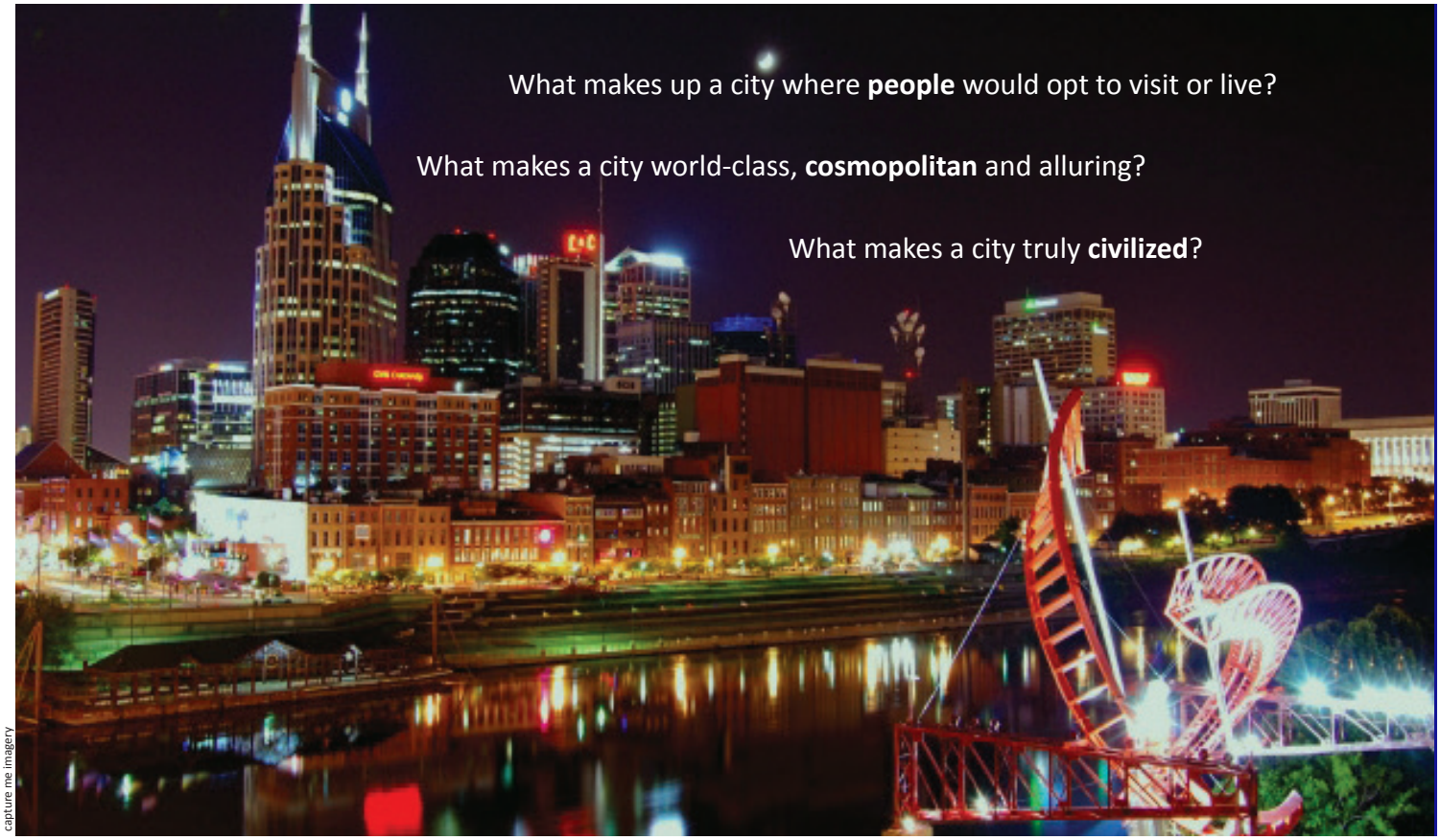


capture me imagery

What are things a city of this caliber must have? The list would include historic roots, water, major airport, distinctive architecture, ethnic diversity, houses of worship, universities and hospitals, a symphony orchestra, art and history museums, libraries, open space, parks and plazas, shopping, pedestrian walks, restaurants and cafés, a zoo…

... and most of all, **BEAUTY**, something above utility that unites all these separate features. Beauty, along with other benefits such as **safe, healthy, well-functioning environments**, is the byproduct of excellent **design, planning and maintenance**.

The purpose of this document is to provide guidance for a more holistic, thoughtful, cost-effective and sustainable approach to the impacts we, as landscape design and development professionals, have on our community. As Nashville advances toward becoming the great city envisioned, we recognize a need to make landscape information more accessible, consolidated and standardized.

SUSTAINABILITY
is design, construction, operations, and maintenance practices that meet the needs of the present without compromising the ability of future generations to meet their own needs.

In addition to providing principles and theory of sustainable design, and references, examples and instructions of best practices, this document will outline the basic process of landscape development in Metropolitan Nashville, from pre-design to construction. Its comprehensive approach applies to all land uses within Davidson county including:

Public Land- Parks, greenways, schools, libraries, Metro Government properties and service sites, street right-of-ways, easements and conservation land.

Commercial Land- Industrial sites, businesses: retail & office, sports and entertainment venues.

Private Land- High to low density residential, single family residential, convervation and agricultural land.

These **voluntary guidelines** are for use by anyone making land-use decisions including :

Arborists,
Architects,
Business Owners,
City and Regional Planners,
Contractors,
Developers,
Ecologists,
Engineers,
Gardeners,
Government Agencies,
Home Owners,
Horticulturist,
Hydrologists,
Landscape Architects & Designers,
Urban Foresters, and
Surveyors.

THE GUIDING PRINCIPLES OF A SUSTAINABLE SITE

Among land-use professionals there is a growing awareness of sustainable design practices that mimic natural systems and the benefits inherent in this approach. While sustainable building standards are in place for 'green building' under the US Green Building Council's LEED (Leadership in Energy and Environmental Design) program, no such guidelines exist for landscapes. Yet healthy ecosystems are the foundation of all life. Modeled after LEED, the **Sustainable Sites Initiative (SITES)** is being developed to promote sustainable land development and management practices.

We encourage you to re-evaluate conventional practices and adopt the intent, methods and guiding principles of this document and the SITES initiative as you work through the design and construction process.

Do no harm
Make no changes to the site that will degrade the surrounding environment. Promote projects on sites where previous disturbance or development presents an opportunity to regenerate ecosystem services through sustainable design.

Precautionary principle
Be cautious in making decisions that could create risk to human and environmental health. Some actions can cause irreversible damage. Examine a full range of alternatives—including no action—and be open to contributions from all affected parties.

Design with nature and culture
Create and implement designs that are responsive to economic, environmental, and cultural conditions with respect to the local, regional, and global context.

Use a decision-making hierarchy of preservation, conservation, and regeneration
Maximize and mimic the benefits of ecosystem services by preserving existing environmental features, conserving resources in a sustainable manner, and regenerating lost or damaged ecosystem services.

Provide regenerative systems as intergenerational equity
Provide future generations with a sustainable environment supported by regenerative systems and endowed with regenerative resources.

Support a living process
Continuously reevaluate assumptions and values and adapt to demographic and environmental change.

Use a systems thinking approach
Understand and value the relationships in an ecosystem and use an approach that reflects and sustains ecosystem services; reestablish the integral and essential relationship between natural processes and human activity.

Use a collaborative and ethical approach
Encourage direct and open communication among colleagues, clients, manufacturers, and users to link long-term sustainability with ethical responsibility.

Maintain integrity in leadership and research
Implement transparent and participatory leadership, develop research with technical rigor, and communicate new findings in a clear, consistent, and timely manner.

Foster environmental stewardship
In all aspects of land development and management, foster an ethic of environmental stewardship—an understanding that responsible management of healthy ecosystems improves the quality of life for present and future

The Sustainable Sites Initiative

SITES™

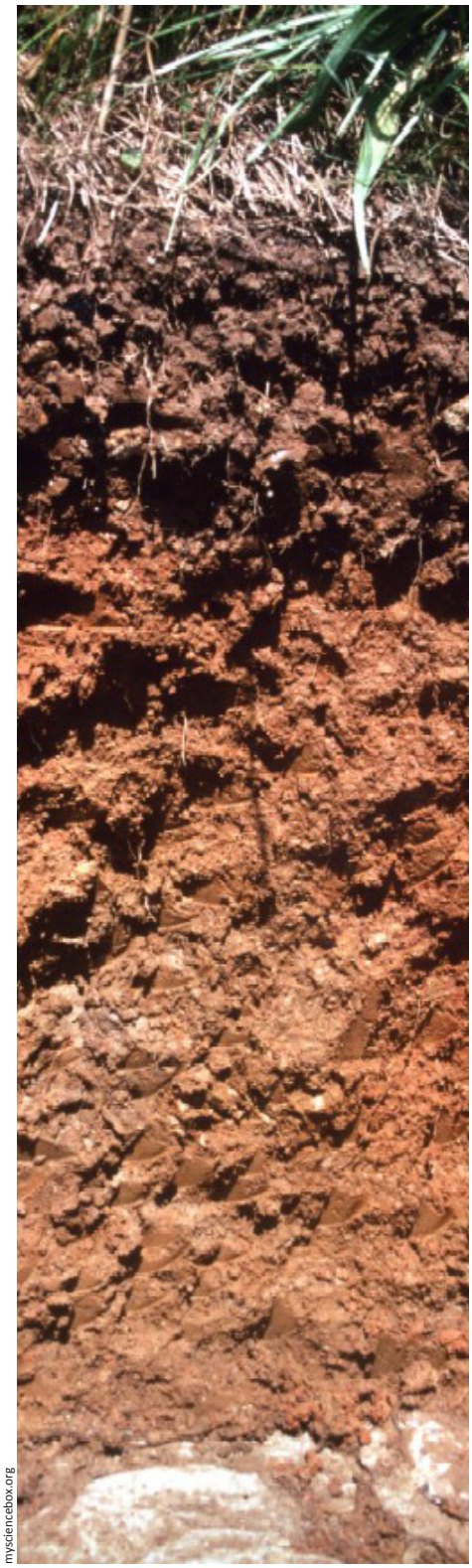
The Sustainable Sites Initiative™ is an interdisciplinary effort by the American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center at The University of Texas at Austin and the United States Botanic Garden to create voluntary national guidelines and performance benchmarks for sustainable land design, construction and maintenance practices.

Information can be found at http://www.sustainablesites.org
The U.S. Green Building Council (USGBC), a stakeholder in the Initiative, anticipates incorporating SITES guidelines into future iterations of the LEED Green Building Rating System.

THREE AREAS OF FOCUS FOR LANDSCAPE PROFESSIONALS

SECTION ONE

Three areas; **soil, vegetation and water** are highly interconnected and crucial for a functional ecosystem. They should be managed as valuable resources, not waste. People often underestimate or simply ignore the value of these "ecosystem services" when making land-use decisions— only to realize later how difficult, expensive, and sometimes impossible it is to replicate services once they are lost.



myscienceblog.org

SOIL

Healthy soil allows rainwater to penetrate, preventing excess runoff, sedimentation, erosion, and flooding. Soils also help clean, store, and recharge groundwater. By storing water and slowing the delivery of water to plants, healthy soils play a significant role in vegetation health. Undervaluing soil is one of the singular failings of the conventional development approach. For example, a frequent consequence of standard construction practices is soil compaction. Construction equipment can seriously damage soil structure by reducing air space between soil particles which are essential for correct air and water movement. If not restored, compacted soil can start a spiral of degradation. Preventing soil compaction is far easier than fixing it. Another practice of stripping topsoil and mixing it with deeper layers of soil to be used as fill dirt should be avoided because it destroys natural soil horizons.

Testing and Analysis- For optimal plant health, soil testing should be performed prior to starting work. Testing should be done annually thereafter. In Nashville soil fertility testing can be done at the University of Tennessee Soil, Plant and Pest Center located at Ellington Agricultural Center. The instructions for soil testing can be found at http://soilplantandpest.utk.edu. The optimum pH range for most plants is between 5.5 and 7.5, however many thrive at pH values outside this range. Analysis of the soil, and the nutrient needs of the plant, will determine if amendments are needed.

Amendments- There are three principal families of amendments: ***organic,*** such as compost and manure; ***mineral,*** including sand, clay based conditioner and ***synthetic*** hydrogels. The particular amendment(s) chosen depend on the type of soil, the plants, the budget and timing since compost takes longer to decompose and release nutrients.

Amendments can benefit the soil depending upon the type of soil and its condition. Organic matter such as compost can increase the soil's water-holding capacity. Organic matter also promotes good soil structure and provides nutrients. The more aggregated, or porous a soil's structure is, the better its drainage and aeration. Larger pores found in a well- aggregated soil allow roots to grow more freely. Water drainage in a heavy clay soil can be improved by amending with large-particle mineral materials, such as sand, perlite, or vermiculite to improve the texture. As organic amendments decompose, they can release nitrogen, phosphorus, potassium, and other valuable nutrients. Although the quantities of these released nutrients are not great, their contribution can complement a regular fertilization program.

STORMWATER GRADING PERMIT

Projects that meet a certain threshold of land disturbance or that alter a site's drainage or the storm sewer system may require a grading permit from Metro Water Services (MWS) Stormwater. Grading permit projects have specific design, inspection, and long term maintenance requirements. Please review Section 3.4 of Metro's Stormwater Management Manual to determine if your project meets the exemption criteria for a grading permit. http://www.nashville.gov/Water-Services/Developers.aspx

MATURE COMPOST

is a stable humus material created by: combining organic wastes (e.g. yard trimmings, food wastes, manures) in proper ratios into piles, rows, or vessels; controlling temperature, moisture and oxygen to achieve accelerated decomposition; and adding bulking agents (e.g. wood chips), as necessary, to provide air space; allowing the finished material to fully stabilize and mature through a curing period. It contains an organic mixture of plant nutrients that are released slowly.

IMMATURE COMPOST

creates bad soil biology and increased vulnerability to anaerobic conditions.

Characteristics of Principal Soil Amendments:

ORGANIC

Compost - The amount of compost to be applied depends upon the organic content of the existing soil as well as the targeted amount of the proposed soil amendment. Compost typically has an organic content of 45-60 percent and is often used as the sole means of providing organic material to the soil profile. In soils that have organic contents of less than one percent, 10 percent by soil weight is a typical target of a proposed soil amendment with compost. As a general rule, a 2-to-1 ratio of existing soil to compost, by loose volume, will achieve the desired organics level. Locally available compost may be utilized if it is of high enough quality and available at a cost effective price.

Nutrients and Lime - If you want to raise the soil pH above 6.0, add pelletized dolomite with application rates in the range of 50 to 100 pounds per 1000 square feet. Nitrogen requirements usually range from 2 to 8 pounds per 1000 square feet, with slow release water-insoluble forms being the preferred method.

Other organic soil additions may include sulfur, manure, worm castings, soil conditioner, dolomite, peat moss and boron.

MINERAL

Sand - Sand can improve soil texture by creating larger pores in heavy clay soils, but sand must be 45 percent of the volume before improving drainage which makes this approach difficult in large areas. In lesser quantities, the sand particles will actually fill existing pores, making drainage poorer than it was previously making this an option better for localized situations such as small rain gardens.

Calcined Clay - Calcined clay is a rigid, odorless mineral that resembles cat litter. Extensively used on golf greens to improve drainage, it can also be incorporated into soils. If incorporated in large enough quantities, the calcined clay particles can keep a soil loose and aerated and encourage deep, sturdy, and healthy root structure.

STPAUL.GOV

SYNTHETIC

Hydrophilic polymers (hydrogels) - Hydrogels are hard, crystal-like polymers which, when they come in contact with water, absorb and expand. The absorbed water is then slowly made available to plant roots to prevent or delay water stress. Research has shown that when hydrogels absorb fertilizer salts such as iron, or calcium, they break down and lose their structure. This results in decreasing pore space and insufficient air and water to the roots. Thus, hydrogels can harm soil structure.

For more detailed information on amendments see: Soil Amendments in Landscape Plantings- Cornell University

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SOIL COMPACTION
is physical degradation resulting in increased density and distortion of the soil where biological activity, porosity and permeability are reduced, strength is increased and soil structure partly destroyed. The compaction process can be initiated by heavy equipment or by the passage of animals. Compaction is the cause of many problems such as reduced water infiltration, unhealthy vegetation, and increased erosion risk by accelerating run-off.

Follow the guidelines in this document to avoid unnecessary soil compaction.

Soil Management Plan (SMP) - The Soil Management Plan is a graphic planning tool used to show these basic intents:

- Limit disturbance of healthy soil
- Protect soil horizons and maintain soil structure, existing hydrology, organic matter, and nutrients stored in soils
- Limit grading to areas of previously disturbed soils when possible
- Establish clear construction boundaries to minimize disturbance
- Develop and communicate to construction contractors a Soil Management Plan (SMP) prior to construction to limit disturbance
- Assist soil restoration efforts
- Define the location and boundaries of all vegetation and soil protection zones

The SMP should include the following information:
1. On the soils map, site plan, or grading plan, indicate designated soil management areas for all site soils, including, but not limited to:
   a. Soils that will be retained in place and/or designated as vegetation and soil protection zones.
   b. Soils that will be disturbed during construction, restored, and re-vegetated.
   c. Soils disturbed by previous development that will be restored in place and re-vegetated.
2. Indicate locations for all laydown and storage areas, haul roads and construction vehicle access, temporary utilities and construction trailers, and parking (all of which must be located outside of the vegetation and soil protection zones).
3. Describe how areas of restored soils will be protected from compaction (e.g., vehicle traffic or storage), erosion, and contamination until project completion.
4. Describe treatment details for each zone of soil that will be restored, including the type, source, and expected volume of materials.
5. Outline the footprint of buildings and hardscape (e.g, trails, roads, etc.) and any areas of trees and other vegetation that will be preserved in place.
6. Communicate the SMP to site contractors in site drawings and written specifications.
7. Locations and installation procedures for protective fencing and signage.

Topsoil Harvesting and Preservation- Topsoil should be harvested at the start of grading. It should be stored in an area where it will not do damage such as a previously disturbed area. Cover the pile with breathable fabric, wood chips, or sterile annual grass to prevent erosion and weeds. If needed, amend just before re-spreading. Don't work soil when it's overly wet. Topsoil should come from one source for consistency in drainage.

Nilsson et al. BMC Bioinformatics 2005

Mycorrhizae fungi form a symbiosis with plant roots enabling plants to take up more nutrients. The plant roots in return release sugars for the fungus.

Rejuvenation- Most often the problem with unhealthy soil is compaction. Soil compaction does not allow air and water to reach plant roots. Oxygen and water are the two elements that are most important for plant roots. Without oxygen, plant roots can not respirate, converting photosynthetic made sugars into energy for growth. Additional microbes such as mycorrhizae fungi may suffer too. The compacted soil should be loosened and the fungi replaced in the form of mycorrhizae fungi. The combination of the two can result in a more stable soil that is less susceptible to erosion and better able to retain water. Soils can be loosened by core aeration and organic amendments. It took millions of years to create natural soil horizons but they can be disturbed in seconds. It will take time and care to restore the soil back to healthy conditions that can give the newly-planted landscape every advantage to grow into the attractive setting that was designed.

Engineered Soil- Engineered soils can be designed for specialized applications such as urban tree boxes, rain gardens, and green roofs.

CU-Structural Soil™- was developed at Cornell University as a method to safely bear pavement loads after compaction and yet still allow root penetration and vigorous tree growth. It has high stone and gravel content with a small amount

of hydrogel. Some issues with poor nutrient uptake have been noted on local projects using this method. Designers are moving away from this approach and working with alternatives such as suspended pavement systems.
Deeproot Silva Cell - http://www.deeproot.com/blog/blog-entries/suspended-pavement-at-the-bartlett-tree-lab-year-8
citygreen Strata Cell - http://www.citygreen.com/products/structural-cells/stratacell

Rain Garden Soils are designed with a high content of coarse sand to allow infiltration and drainage of storm water. Bioretention areas designed to treat stormwater for compliance with Metro's water quality standards have specific soil mixture requirements. http://www.nashville.gov/Water-Services/Developers/Low-Impact-Development.aspx

Green Roof Soils are designed for shallow depths and to be light weight. By using a mixture of native soil upgraded with organic or mineral additives (peat, humus, wood chips, sand, lava, or expanded clay), it is possible to achieve optimum water retention, permeability, density and erosion control necessary to support the Green Roof vegetation. Green roof soil mixtures designed in compliance with the Green Roof specification should contain no more than 15 percent organic matter.

http://www.stormwaterresourcesformunicipalities.com/monroe_county.htm

Without proper erosion control stormwater runoff from construction sites depletes topsoil and pollutes streams.

Erosion Control- We have all seen erosion on major construction sites but small areas are also susceptible to runoff and erosion. Sometimes the process can be subtle such as exposed roots or soil and mud on pavement. Erosion is unsightly and can be dangerous. Rainfall or excess irrigation causes runoff from lawns, roads, parking lots and farm fields. Eroding topsoil can contain contaminants such as fertilizer, pesticides and petroleum products. All of these contaminants end up downstream and sometimes in our water supply. Projects that require a Metro grading permit have specific Erosion Prevention and Sediment Control Plan requirements. Please see Section 4.2.2.2 of Metro's Stormwater Management Manual for additional information.
http://www.nashville.gov/Water-Services/Developers.aspx
Stabilizing the soil on a slope is the answer. Here are ways to control a slope:

Baffles or barriers are obstruction devices that slow down or divert water from flowing directly downhill. They consist of partially buried stone or timbers (laid parallel to the slope). These barriers work best for lesser slopes.

Stone (at least 6"-8" wide each). The stone is embedded into or spread loosely onto the slope. Stone also slows and diverts flowing water.

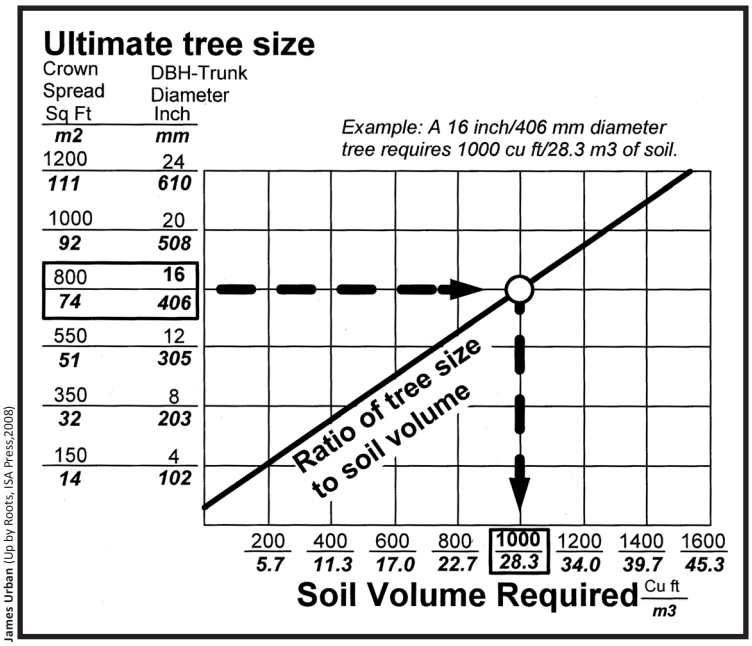
Terraces "stair-step" the slope. The flat surfaces allow you to plant on the terraced levels. Terraces allow water to infiltrate instead of running off. Use timber, stone, concrete or precast concrete block to build the retaining walls. Start at the bottom and fill in the level above with soil from the area just leveled (a technique called cut and fill). Terraces should slope a bit (about 2% is recommended) to prevent water from collecting at the back of the terraced portion. Remember that mortarless retaining walls can only reach a height of about 2 feet. Check the specifications of the product you are using for height restrictions. Also remember to backfill the area behind the wall with crushed rock and add weep holes to ensure drainage. If you build a terrace around existing trees, make sure the soil level is not raised. Covering the roots even a few inches can damage or kill the tree.

Plants can be used to reduce erosion on slopes. Any of the slope control methods can be planted. When plants are established, the roots help anchor the soil. Getting seeds established on a slope can be difficult. Seeds and mulch wash away and planting holes are eroded before the plant gets established. A covering of straw can help secure the seed and reduce water runoff. On steep slopes you may need to hydroseed.

SECTION ONE

Blankets- Another method is a seed germination blanket. The blanket is a combination of biodegradable and wood fiber that holds seed and fertilizer in place until seedlings can take root. A maintenance plan for invasive plant control will need to be put in place until establishment.

Temporary remedies include: plastic sheets, straw bales, straw-blankets, silt fences and mulches. These are short-lived, as they will biodegrade or wash away over extended periods of time.



James Urban (Up by Roots, ISA Press,2008)

Soil Depth for trees- Tree soil should have a minimum depth of 3 feet or enough depth to allow for the root flare at the base of the tree to be even with the finished grade. The soil can be a mix of topsoil and subsoil. When installing the soil it should be installed in 12 inch deep lifts or layers. The final topsoil layer should be at least 12 inches deep. Before installing lifts, the subgrade soil surface should be tilled or loosened to break up any compaction that occurred. The same should be done between lifts if any compaction occurs.

Sinkholes- or eroded bedrock, are common in Middle Tennessee. Our geological area is known for Karst topography which features subsurface erodible limestone that results in sinkholes and caves. Sinkholes can be a natural occurrence or can form over time from man-made features that cause water to accumulate such as retention ponds and ground-water pumping. They can range in size and cause major destruction when large. Remediation can be challenging. When avoidance is not possible, some methods include filling, capping or converting to a water feature. Sinkholes should be shown in survey information.

Soil Volume for Street Trees-
The amount of soil installed will in large part determines the maximum size that the tree will achieve during its usable life span. Only the upper three feet of soil should be used for calculations in this table. The example illustrated shows that to achieve a trunk diameter of 16 inches,1000 cubic feet of soil are needed.

Soil Specifications- The topsoil and subsoil may be from either a naturally occurring soil or soil that has been mixed to achieve these requirements.

Texture. Both top and subsoil should be a sandy loam soil with 50-80% medium and coarse sand (<25 % fine sand), 5-20% clay, 5-35% silt.

Stones and rocks. No stones larger than 1 " in the longest dimension are allowed. Stones ranging from 0.50" to 1 " shall not exceed 5% of the soil volume, and gravel 0.25 to 0.50 " shall not exceed 5% of the soil volume.

Debris content. Particles greater than 1 " in the longest dimension are not allowed. This includes fragments of brick, concrete, wood, glass, metal, stone and plastic. The total volume less than 1 " long should not be more than 5% of the soil volume.

Contaminants. The soil should have no herbicides, heavy metals, biological toxins, or hydrocarbons that will impact plant growth or are at levels exceeding the EPA's standards for soil contaminants.

Clod size. Mixed soils often contain soil clods with high clay content. While smaller soil aggregates are desirable from a soil drainage perspective, larger clods are not. Therefore, it is permissible to have unlimited amount of natural aggregates that are less than 1 " long, but clods from 1-3 " should make up less than 10% of the soil volume and clods 3-6 " should be < 5%.

TOPSOIL

Topsoil is one of our most important natural resources. It can take 500 years for one inch of topsoil to be made. It is becoming a scarce commodity largely due to poor landscaping practices.

Quality topsoil is crucial for healthy plants. A quality topsoil will have the proper balance of nutrients and is the right texture. Have a soil test done before purchasing.

There are no regulations for selling topsoil. Be cautious and know the soil's history before purchasing.

Avoid soils that may have residues of herbicides, pesticides, chemical fertilizers and weed seeds.

Do not allow quality existing topsoil to be sold from the jobsite. When possible existing soil should be reused on-site.

Soil Specifications continued-

Organic matter content. Organic matter (OM) is important for retaining water, maintaining stable soil aggregates, promoting biological diversity and providing nutrients for tree growth. The top soil shall have 4-6% OM by weight. If additional organic matter is needed, compost can be added to the soil. A well composted yard waste or wood chips compost can be used, as long as there is 10 % OM by volume in the compost. No soil mix should contain more than 15% compost by volume so as to avoid settling/subsidence problems. Subsoil should have between 1-3% OM, but higher levels are not detrimental.

Density. Soil density needs to be high enough to avoid settling, yet low enough to allow root growth. Top soil should have a density of 1.0 to 1.4 g/cc and subsoil 1.2 to 1.5 g/cc. A vibrating plate compactor should be used between 12 " lifts to settle the soil. Number of passes required needs to be determined on site. A starting point is two passes of a 20 " impact plate vibrating compactor on a moist (not wet) soil to achieve the desirable density. Take care not to overly compact the soil.

Drainage. Water should readily drain from the soil. Percolation rates of 1-2 " per hour are preferred A drainage system should be installed if the native subsoil has a drainage rate less than 1 " per hour. Corrugated, slotted pipe should be used for drainage. Slots must only be on the bottom half of the pipe. If pipe has slots on the top, plastic sheeting should be taped to the top to prevent soil contamination of the pipe. Drain pipe should be surrounded with coarse sand and should not be wrapped with filter fabric to avoid future clogging problems. The coarse sand trench should be at least 12 " wide and 10 " deep, with the pipe in the center. The pipe must slope at a minimum 2% downhill to an appropriate drainage area.

Soil pH. Soil pH determines the availability of nutrients in the soil. The desired pH range is dependent on the plant species. Generally, a pH range is 5.5-6.6 is suitable for most plants. Test soil for pH and nutrients prior to planting. University of Tennessee Soil, Plant and Pest Center- Ellington Agricultural Center soil testing: http://soilplantandpest.utk.edu

Soil Drainage Perk Test

STEP 1- Dig a hole at least 6" in diameter by 12" deep, with straight sides. If you're testing a large site, dig several holes scattered around, since drainage can vary.

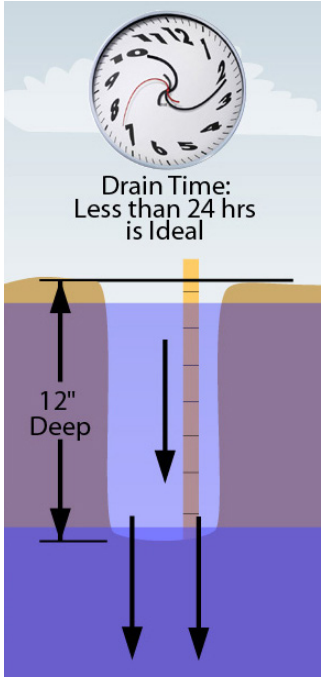
STEP 2- Fill the hole with water, and let it sit overnight. This saturates the soil and helps give a more accurate test reading.

STEP 3- The next day, refill the hole with water.

STEP 4- Measure the water level by laying a stick, pipe, or other straight edge across the top of the hole, then use a tape measure or yardstick to determine the water level.

STEP 5- Continue to measure the water level every hour until the hole is empty, noting the number of inches the water level drops per hour.

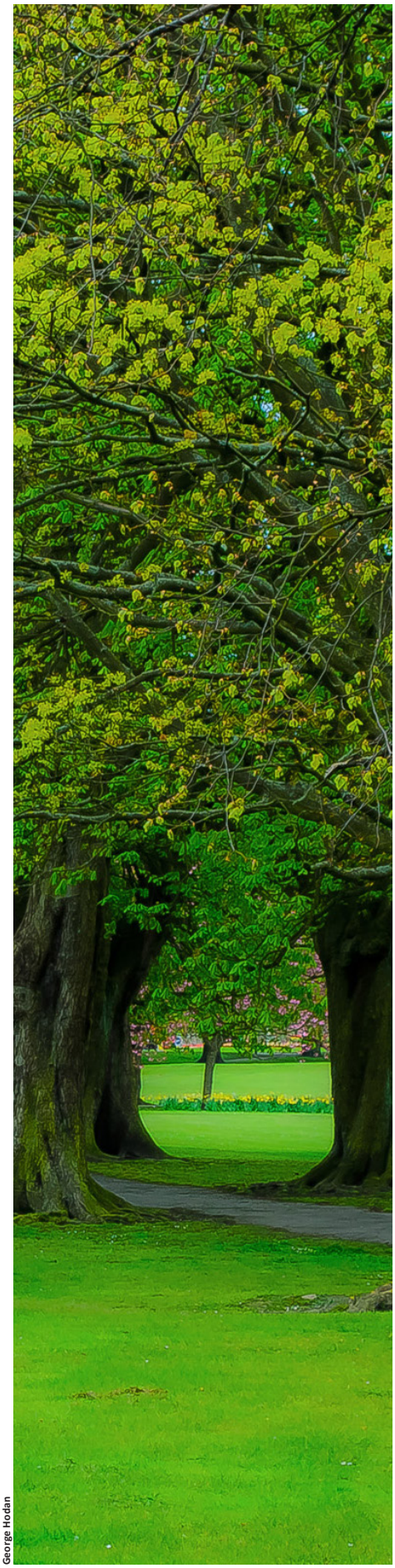
The ideal soil drainage is around 2" per hour, Readings between 1"- 3" are acceptable. A rate less than 1" per hour is too slow. Improve drainage or choose plants tolerant of wet soil.



Nutrients. Plant available nutrients should be tested prior to soil installation. If they are found to be at levels that are listed as "medium" or less on the soil analysis report the soil should be amended with the appropriate fertilizers. If nitrogen is required, the nitrogen fertilizer shall contain at least 50% of the total N applied in a water insoluble (WIN) form.

Soluble salt content shall be less than 2 dS/m.

Water is an essential component of keeping plants alive and thriving. Soil moisture should be monitored regularly and water applied when needed. Over watering can also harm plants. Install soil moisture sensors at the time of soil installation.



George Hodan

SECTION ONE

VEGETATION

Removing existing vegetation disturbs soils and can lead to irreversable consequences. Without vegetation, a site loses its natural ability for filtering stormwater and groundwater recharge. Reduced vegetative cover also affects soil health, because vegetation helps maintain soil structure, contributes to soil organic matter, and limits erosion. Excess sedimentation is the major cause of polluted rivers and streams in Nashville. Sediment runoff rates from construction sites can be up to 2,000 times greater than those of forested lands. By adopting a Vegetation Management Plan with defined vegetation protection zones, a sustainable approach to site design and construction would preserve or restore appropriate vegetation on the site and preserve native plant communities and mature trees. It takes decades to replace what is lost when a site is cleared to make way for construction. Thoughtful observation of the existing natural systems and proper planning can preserve and enhance the many ecosystem benefits and services. Design and planning tools for this purpose include:

Vegetation Management Plan (VMP)- The plan should show:

- a tree survey to define location, size, and quality,
- areas of other significant vegetation,
- overhead and underground utilizes,
- trees to be removed,
- trees to remain,
- treatments such as pruning , fertilization and pesticides,
- tree protection zones,
- fencing and signage details,
- note to contractor to avoid anything that will cause damage to trees such as compaction of the root zones or scarring and breakage from equipment.

A pre-construction meeting should be held to educate all construction and maintenance personnel about the plans and protective measures.

Protect and Restore Open Space- The EPA defines Open Space as; any open land that is undeveloped (has no buildings or other built structures) and is accessible to the public. Open space can include green space (land that is partly or completely covered with grass, trees, shrubs, or other vegetation) such as parks, community gardens, cemeteries, schoolyards, playgrounds, public seating areas, public plazas and vacant lots. Just as in any other land uses, the way Open Spaces are managed can have good or bad environmental impacts, such as pesticide runoff, siltation from overused hiking and logging trails, and destruction of habitat. Information and tools for protecting Open Space can be found on the EPA's website Open Space Development- http://www.epa.gov/owow/NPS/ordinance/openspace.htm

In March 2011, Metro Nashville completed the Nashville Open Space Plan for Davidson County. It should be a guide for local development projects when relevant. It can be found at: http://www.nashville.gov/Portals/0/SiteContent/Sustainability/NashvilleOpenSpacePlan.pdf

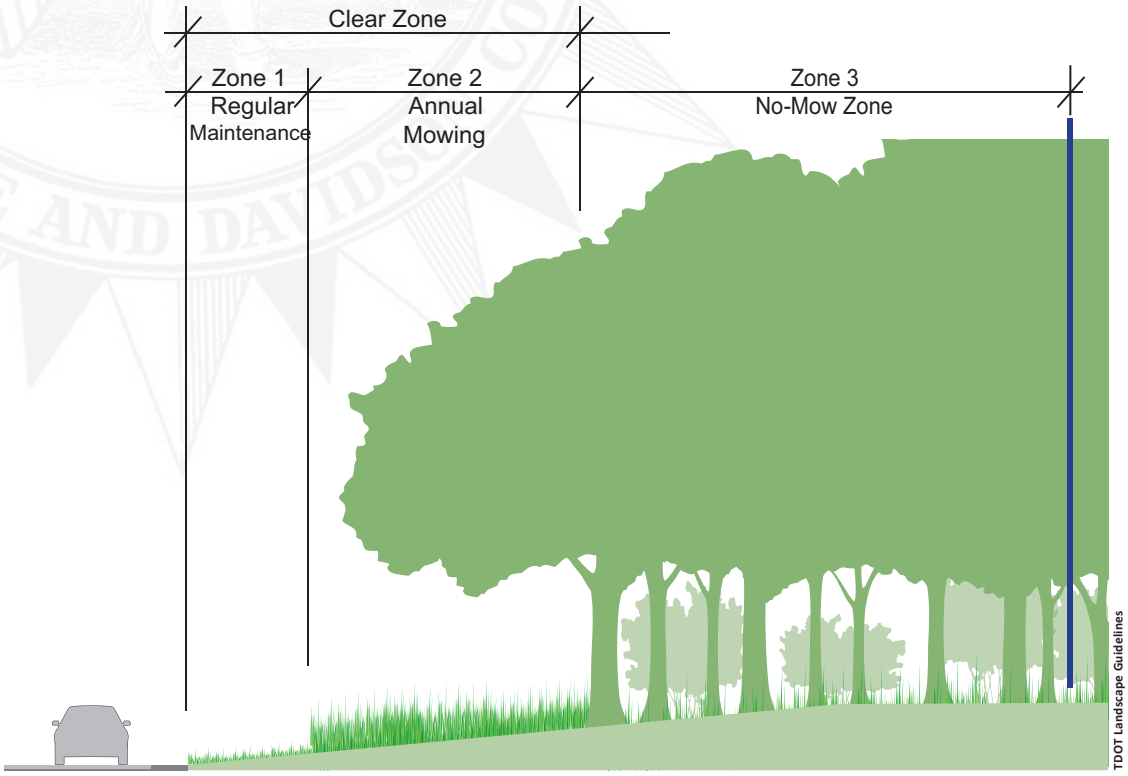
Preserve and Restore Indigenous Plant Community native to the ecoregion of the site to contribute to regional diversity of flora and provide habitat for native wildlife. Use this community as the reference model for planting design. If the project has no healthy plant community, look off-site to nearby undisturbed areas as a model.

Use Native Plants for both formal and naturalistic designs when they are the best choice. On sites with existing native plant communities, design the site to minimize damage to existing healthy native plant communities, especially those areas that provide opportunities for connectivity. See links to native plant resources in SECTION FOUR-RESOURCES page 32.

Information specific to producing planting plans compatible with Metro Urban Forestry Guidelines can be found at:
http://www.nashville.gov/Codes-Administration/Codes-Administration/Publications-List/General-Publications-List.aspx
Metro Landscape Zoning Ordinances
http://library.municode.com/index.aspx?clientId=14214

Nursery Plant Quality Standards from the American National Standards Institute (ANSI) 2004 American Standard for Nursery Stock publication can be found at: http://www.anla.org/index.cfm?area=&page=Content&categoryID=260
The new release of ANSI A300 (Part 6)-2012 Planting and Transplanting standards can be found at: http://www.tcia.org/business/business-resources/ansi-a300/part-6

Define and Reduce Areas of High Maintenance Turf Grass- According to one estimate, 40 million acres of land is devoted to turf grass in the United States with nearly 75 percent in home lawns. More than 30 billion dollars are spent on annual lawn maintenance. This annual expenditure could be significantly reduced by using a Landscape Management Plan and taking an Integrated Pest Management approach using cultural, chemical and biological methods to manage diseases, insects and weeds. Both are important parts of a sustainable lawn care program. Sustainability as it relates to lawns can be defined as a lawn area that requires few material inputs while having a positive impact on the environment. Creating a more sustainable lawn requires proper selection of the best adapted grass species as well as proper site preparation, lawn installation, and appropriate maintenance.
Reduce mowing by creating maintenance 'zones'.



Improve Conditions for Street Trees- Urban conditions are hard on street trees and many suffer from limited root space, poor and compacted soils, and injuries to their trunks and branches. Coordinated design with ample space for growing trees, protection from vehicles and people, and consistent maintenance will help street trees grow and thrive. Some recommendations are:

- Prioritize space and location for street trees.
- Choose quality, local or regional trees and disease resistant species.
- Incorporate street-side stormwater management techniques like tree box infiltration planters, bioswales and stormwater curb extensions.
- Update streetscape standards to improve soil volumes that ensure tree roots have room to grow. See Soil Volume for trees page 9
- Relieve compacted soil around trees with radial trenching, vertical mulching, compost stirring and root flare excavation.

SECTION ONE

- Removing excess fill and mulch at base. Pull mulch away to not contact tree bark.
- Street trees are not always permanent. Plan to replace them at some point when they no longer fulfill their designed function.
- Remove or cut girdling roots.
- Young trees need a training prune to avoid future problems (crossing or rubbing branches, multiple leaders, etc.) and periodic future pruning to keep sidewalks, roads, buildings and light poles clear of branches. See SECTION THREE page 23 for pruning guidelines.
- Increase habitat diversity and disease resistance by not planting trees of only one species or 'monocultures'.
- Protect existing trees during streetscape construction by enforcing regulations and incorporating street design techniques like rubber sidewalks and bump-outs.

Nashville.gov

Deaderick Street, Nashville-Tennessee's first Green Street http://www.asla.org/uploadedFiles/CMS/Advocacy/Federal_Government_Affairs/Stormwater_Case_Studies/Stormwater_Case 242 Deaderick Street Renovation (Green Street), Nashville, TN(1).pdf

• Salt and other chemical deicers for streets should be avoided when possible. Track the weather and only use deicers when there is a high probability of snow or ice. Snow should be shoveled or plowed when possible. If the temperature will remain above 23 F, use calcium magnesium acetate (CMA). Sand can also be combined with deicers to reduce salt amounts. Apply deicers sparingly and never at a rate greater than the manufactures' guidance. Pervious pavements typically manage frozen precipitation better than solid pavements. Use salt tolerant species in areas that will unavoidably receive high concentrations of salt. For more information see: http://www.mde.state.md.us/assets/document/WINTER_2.pdf

• Establish partnerships with business districts, community groups, nonprofits and residents to water, monitor and care for trees and landscape in public areas.

• For information on state roadway landscaping see TDOT Landscape Guidelines - http://www.tdot.state.tn.us/environment/beautification/landscapedesign.htm

Invasive Plants Control- Landscape professionals need to be knowledgeable about invasive plants and understand how to recognize, manage and avoid spreading them. The USDA publication; A Management Guide for Invasive Plants in Southern Forests is an extensive guide to all issues concerning invasive plants. To download go to: http://www.srs.fs.usda.gov/pubs/36915. USDA resources on invasive plants specific to Tennessee can be found at: http://www.tneppc.org/invasive_plants

Plants for Erosion Control- Deep rooted native grasses, wildflowers, clump-forming ornamental grasses, shrubs or other perennial native plants usually adapt quickly to slopes and unimproved soil. Loblolly Pine (Pinus taeda) is one of the best trees for erosion control. The fallen needles lock together to form a protective layer over the soil.

Turfgrass can control erosion on minor slopes if the grass is healthy. A grass such as annual rye can germinate quickly and help stabilize soil while perennial grasses can get established. Compacted soil is a major contributor to runoff. Aerate if possible, and add organic matter such as compost to promote a healthy stand of grass. For more information see TN Dept. of Environment and Conservation, TN Erosion and Sediment Control Handbook: http://www.mtas.tennessee.edu/citydept/pw/bmptoolkit/sedimentcontrol.pdf

George Hodan

WATER

Freshwater resources are under duress all over the world, and Tennessee is no exception. Even the Nashville area has been experiencing extreme conditions from flooding to droughts. Meanwhile, demand for water in the United States has tripled in the last 30 years, even though population has only grown 50 percent. As water rates rise, the imbalance between supply and demand has become so striking that water will become "the petroleum for the next century." Yet the two widely accepted practices of irrigation and conventional stormwater engineering not only contribute to the imbalance but also ignore the looming crisis.

A sustainable approach to design begins by doing an inventory and assessment of all hydrologic features of a project site. The plans would include; water bodies, flow patterns, damp soils, storm and/or waste water utility line locations, existing irrigation, water lines, flood zones, groundwater recharge areas and riparian zones. The study area should extend beyond the project site limits to the watershed level for a better understanding of the dynamics affecting the site. This information is used to develop design and management plans that address water issues and prioritize objectives such as:

- Protect and restore natural hydrology and riparian, wetland and shoreline buffers. Buffer restoration may require the approval of Metro Water Services. Please see Section 6.9.6 of Metro's Stormwater Management Manual for additional information.
  http://www.nashville.gov/Water-Services/Developers.aspx and
  TVA - http://www.tva.gov/river/landandshore/stabilization/index.htm
- Manage stormwater on-site to reduce flow to storm water systems and increase ground-water recharge
- Reduce or eliminate irrigation
- Use non-potable water for irrigation
- Use permeable hardscaping

Wasteful Irrigation- The decision to include an irrigation system on a site must be done on a case-by-case basis to determine if the benefits outweigh the costs.
Currently the Metro landscape ordinances require:

> *Watering. All required landscaping, excluding trees planted or preserved on residential property in accordance with Section 17.24.100 of this chapter, shall be watered by one of the following methods: 1. An underground sprinkler system; 2. An outside hose attachment within one hundred feet of all landscaping.*
> http://library.municode.com/index.aspx?clientId=14214

Irrigation of unsustainable landscapes accounts for more than a third of residential water use—more than 7 billion gallons of treated potable water per day nationwide. With soil compaction a common problem in developed areas, the infiltration rates of water are significantly reduced, causing much of the water used to irrigate lawns to end up as runoff or evaporate instead of percolating into the soil. Irrigation maintenance guidelines to help run your system efficiently can be found in SECTION THREE-MAINTENANCE, Part E- IRRIGATION page 29.

A sustainable approach to landscape irrigation design would minimize or eliminate the use of potable water or the drawing off of natural surface water or groundwater for landscape irrigation once plants are established. Ideas for water harvesting and other Low Impact Design methods can be found in the SECTION FOUR-RESOURCES page 32.

Conventional Stormwater Engineering- In most cities, rainfall is treated as waste, to be funneled directly from gutters and drains to sewers. In older cities such as Nashville, the stormwater from a portion of the downtown area drains into combined sewer/

SECTION ONE

Click image to view document

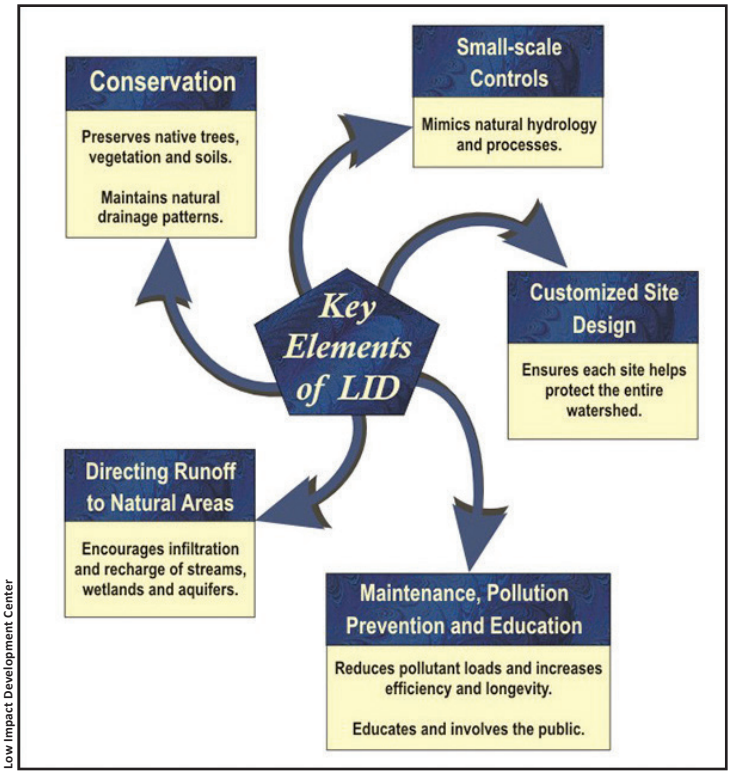
stormwater systems that flow to water treatment plants, thus raising the cost of purifying drinking water. In heavy storms, these combined sewer systems can overflow, dumping raw sewage into fresh water.

Rather than getting rid of stormwater runoff as quickly as possible, a sustainable approach to stormwater management would find ways to capture it on site and use it for irrigation, bioretention gardens, and groundwater recharge.

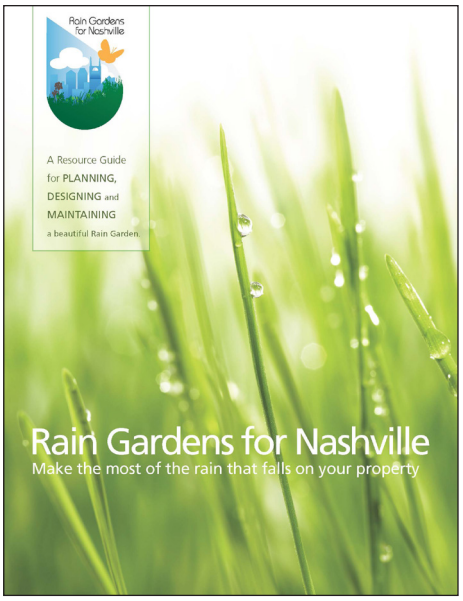
Water pollution- Without a sustainable approach to managing water on site, excess runoff damages soils and vegetation that help to filter and cleanse water. During heavy rains, water leaving developed sites can contain a host of pollutants. These pollutants may range from excessive nutrients, silt, fertilizer, oil, grease, toxic chemicals, animal waste and heavy metals to biological contaminants such as E. coli and hepatitis A. Stormwater runoff is one of the leading sources of pollution for all water body types, with impacts that can escalate with increased development and urbanization.

Low -Impact Development (LID) is a land planning and engineering design approach to managing stormwater runoff. LID emphasizes conservation and use of on-site natural features to protect water quality. This approach implements engineered hydrologic controls to mimic the pre-development hydrologic regime through filtering, infiltrating, storing, evaporating, and detaining runoff close to its source. LID addresses the objectives of sustainable design and provides the tools for implementation.
To learn more about LID see SECTION FOUR-RESOURCES page 32.

Key Elements of Low Impact Development



Low Impact Development Center



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Every project has its own unique set of design parameters. This document will not only cover design principles and theory but will touch on the basic elements of the design process as it relates to Landscape Guidelines and Best Management Practices.

Victoria Transport Policy Institute

Complete Streets

While designing for sustainable, low impact environments, also consider incorporating Complete Street concepts when applicable. Complete Streets are streets which are designed and operated to enable safe, attractive, and comfortable access and travel for all users, including pedestrians, bicyclists, motorists and public transport users of all ages and abilities. For more information on how to plan using Complete Street concepts see:

NashVitality- http://www.nashvitality.org/active/building-active-places/complete-streets.aspx

I- PRE-DESIGN- When selecting the design team, it is best to work with local design professionals well versed in the local regulations, practices and plant communities.

1. **Project Acceptance-** Agreement between the client and the designer on scope of services, products and costs.
2. **Research and Analysis-** To achieve a thorough understanding of the background of the project and the conditions that will affect the end result. Tasks include:
   a. Site Visit- Include photographic documentation. Soil testing if needed.
   b. Base Plan Preparation- Ideally is a professional survey to scale and includes:
      - Property line with bearing, distance, north arrow and scale bar
      - Topography and spot elevations
      - Vegetation- All trees over 6 inches DBH with their size, species and condition. Other significant vegetation such as tree lines and shrubs
      - Bodies of water- Streams, lakes, ponds, wet areas
      - Buildings- locate windows, downspouts, electrical features and exterior lights
      - Other features-including roads, drives, parking, paths, terraces, walls, fences, culverts, headwalls etc.
      - Utilities- Overhead and underground lines
      - Off-site adjacent conditions
   c. Site Inventory and Analysis- Determine the site's character, problems and potential. Work with drawings that 'layer' information.
   d. Client Interview- Obtain information about uses, needs, budget and wishes.
   e. Program Development- A list of goals, design elements and special requirements.

II- DESIGN- Throughout the process; designers will work with the client and stakeholders to develop the best solutions based on the program criteria, site data and Metro ordinances. Some important design standard links are:
Metro Zoning Landscape Ordinance - http://library.municode.com/index.aspx?clientId=14214
Metro Stormwater - http://www.nashville.gov/Water-Services/Developers.aspx
Americans with Disability Act (ADA) - http://www.nashville.gov/General-Services/ADA-Compliance/Links-and-References.aspx
Metro Urban Forestry worksheet and other related documents - http://www.nashville.gov/Codes-Administration/Land-Use-and-Zoning-Information/Urban-Forestry.aspx
The following are the results of the design process.

1. **Functional Diagrams-** loose studies of ideal relationships applied to site conditions.
2. **Concept/Schematic plan-** detailed drawing of specific uses and areas drawn to scale.
3. **Design Development plans-** detail the appearance and integration of elements and materials.
4. **Master Plan-** all elements drawn together in a realistic, complete graphic manner.
5. **Construction Documents-** technical and mechanical communication on how to construct all elements.
   a. Layout Plans
   b. Management Plans
   c. Grading/Drainage Plans
   d. Planting Plans
   e. Construction Details.
   f. Written Specifications

Download planting details and specifications, International Society of Arboriculture
http://ww.isa-arbor.com/education/onlineResources/cadPlanningSpecifications.aspx

TREE REMOVAL PERMIT

A tree removal permit is required whenever a tree or trees are to be removed, and are greater than six (6") inches in diameter.

This may be waived if the property is zoned for Single Family Residence or Duplex Residence, or a valid Building Permit has been issued.

III- IMPLEMENTATION
BIDDING PROCEDURES

Metro Purchasing Dept. has numerous ways in which the Bidding Process can be executed for design and/or construction services. This simplified outline illustrates a typical construction project.

The **Contract Documents** will include the construction documents, the general conditions documents, pricing tabulation sheets and bond requirements. The written specifications define the requirements for quality, performance and warranty of materials and construction. The industry standard for specifications is provided by the Construction Specifications Institute (CSI) – MasterFormat- http://www.masterspec.com/structural_civil_landscape_specifications.aspx

The Contract Documents are issued along with a **Request For Proposals (RFP)** by either an open (public) or closed (pre-approved contractors) solicitation to vendors to submit bids. Within Metro, bid requests can be found on the Metro Purchasing Procurement website and sent via email through Metro's Workflow Mailer to pre-approved contractors. Information on doing business with Metro as well as lists of Metro Pre-approved contractors and design consultants can be found at the iProcurement System website- www.nashville.gov/Finance/Procurement/iProcurement-and-iSupplier.aspx. The RFP will contain all the information about what is required for the submittal. The bidding process will close on a date and time specified in the RFP.

The bid packets will be evaluated by a group of representatives from the Metro departments involved in the work, a representative from the Purchasing Dept. and a representative from Metro Office of Minority and Women Business Assistance. The proposals may be narrowed down to a few candidates called a 'Short List'. These bid teams may be asked to have an interview with the Metro evaluation group to answer questions in more detail. The bid team making the highest score during the evaluation process will be awarded the work. They will then go through contract negotiations to determine both parties' responsibilities, schedules and fee. After these negotiations are complete they will receive a 'Notice To Proceed' and work can begin.

The **Permitting Process** must be mentioned here as well. Depending on the size and impacts of the project, one or more permits will be required. The requirements must be determined on a case-by-case basis. Included in SECTION FOUR- RESOURCES pg 32 of this document are links to various Metro Departments involved in permitting.

IV- CONSTRUCTION

The Landscape Professionals level of involvement during construction will vary based on their role and contract responsibilities. At a minimum, the Landscape Professional is expected to have a pre-construction meeting with the contractors to see that all directives are clearly understood. They also will make regular site visits to inspect the quality of plant material, topsoil and installation and to see that the work is going according to the plans. Photographic documentation is advised.

V- POST-CONSTRUCTION EVALUATION

When construction is complete, the Landscape Professional will do a final inspection. If corrections are needed they will produce a 'Punch List' outlining the deficiencies. After these have been corrected the Landscape Professional will send a letter to the Metro Urban Forester in the Codes department stating that all work is complete.

The last action required in the Construction Phase is to produce a set of 'As-Built' drawings to document any changes to the plans made during construction. These will be included in the close-out documents and kept on file for future reference.

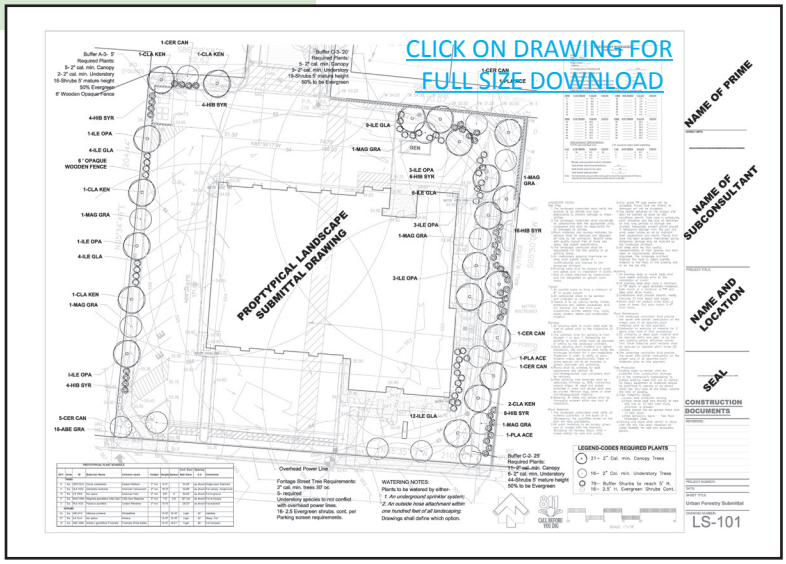
Urban Forestry Permit Submittal Drawing

The landscape plan submittal drawing should show:

- ☐ Name and address of project
- ☐ Permit number
- ☐ Name and contact information of designer and project manager
- ☐ Signed and dated seal of licensed professional overseeing design
- ☐ Scale bar
- ☐ North arrow
- ☐ Topography
- ☐ GPS coordinates
- ☐ Zoning of project limits and all adjacent parcels
- ☐ Location of all overhead and underground utilities
- ☐ TN One-Call number (811)
- ☐ Location of all protected trees
- ☐ Tree protection fence
- ☐ Replacement trees
- ☐ Tree Density Units (TDU) calculation worksheet
- ☐ Required Street trees
- ☐ All plant material for required landscape buffers
- ☐ Irrigation system or hose bib attachments
- ☐ Plant schedule listing –quantity, units, Latin and common name, hybrid or cultivar name if applicable, caliper and/or height, spacing, container or root ball size
- ☐ General and Special Notes to contractor
- ☐ Low Impact Stormwater Design should be shown for review by the Stormwater Department.

Other drawings included in the submittal will include all relevant construction and installation details such as tree and shrub planting, mulching etc.

See SEE SECTION FOUR-RESOURCES page 32 for helpful links.



Prototypical Urban Foresty Submittal Drawing

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MAINTENANCE

SECTION THREE

Anyone involved in landscape maintenance should adopt a **Landscape Managment Plan (LMP)** to ensure that the landscape will be successfully established and continue to function well over time.

Sites that are developed under a grading permit will have a Long Term Management Plan (LTMP) that identifies the specific requirements for maintenance of the stormwater features. The LTMP should include a landscape plan identifying the plants required in Bioretention areas, Green Roofs, and Water Quality Swales. This Plan should be used for plant replacement unless other species are approved by Metro Water Services. The LTMP is recorded at the Register of Deeds.

A. LANDSCAPE MANAGEMENT APPROACH

The landscape is designed to:

- Provide a **pedestrian friendly,** enjoyable outdoor environment for users and an aesthetic amenity for the city, nearby residents and passers-by.
- Ensure **public safety** for users. Sight lines are maintained on all sides of the site, with low shrubs and open, limbed-up trees.
- Protect the **health** of workers, and users, as well as the environment, by minimizing use of pesticides (herbicides, insecticides, fungicides, and rodenticides).
- **Low maintenance** plant selection emphasizes native plants and hardy ornamental cultivars to use less water and prevent pests and the use of harmful chemicals.
- Pest, weed, and disease problems that arise are managed through **"Integrated Pest Management" (IPM).**

GLOSSARY

Mulching Mowing or Grasscycling- Mower chops clippings finely and blows mulch down into turf to decompose and feed soil.

Hydroseed- To sow seed mixed with mulch by distribution in a stream of water propelled through a hose. Best for slopes or large areas.

Integrated Pest Management (IPM)- Is an approach to pest control [weeds, insects, and diseases] that uses regular monitoring to determine if and when treatments are needed, and employs physical, mechanical, cultural, and biological tactics to keep pest numbers low enough to prevent intolerable damage or annoyance. Toxic chemical controls are used as a last resort.*

Shearing- Involves using a hedge trimmer to cut plants in an even geometric shape.

Topdressing- is a method of adding compost, mulch, loam, peat, or a combinations of these things, as improvements to the soil, or for leveling existing lawns. It should be compatible with your existing soil needs.

Organic Bridge Fertilizer- Synthetic organic slow-release nitrogen (urea) blended with natural organic fertilizers (manure, plant, animal or fish by-products) to give it a variety of nitrogen levels and release responses.

Aeration- the process of using mechanized equipment to puncture the soil with spikes (spike aeration) or remove 1 inch x 2 inch cores of soil from the ground (core aeration). It is done on turf areas to reduce compaction, reduce thatch buildup, improve infiltration and improve seed contact with the soil.

Vertical Mowing-A high-speed machine with vertically rotating blades that slices into the turf to reduce thatch or improve soil aeration.

ET-Based Watering- uses the scientific principles of evapotranspiration (ET) to determine a plants true watering needs. ET is a measure of the amount of water loss from soil evaporation and plant transpiration. Compensating for rates of daily evapotranspiration is critical to delivering precise irrigation schedules.

Blowout- Completely draining an irrigation system to prevent freeze damage during winter.

Crown Reduction- Pruning methods used to reduce the height and/or spread of the crown of a tree by the removal of the ends of branches while maintaining the tree's natural shape as far as practicable

*Daar, Olkowski & Olkowski: IPM Training Manual for Landscape Gardeners, 1992

Maintenance continued

B. LANDSCAPE MANAGEMENT SCHEDULE

See SECTION THREE-MAINTENANCE for definitions and specific practices required by

January:

- * Prune any tree branches that interfere with public safety or sight lines. Prune all street trees yearly to encourage strong upward growth. Do not top trees.
- Mulch mow all turf areas once per month.
- * Clean Permeable Paving

February:

- * Apply granular fertilizer around trees in late February. Make application prior to a moderate rainfall so the rain will wash the fertilizer in. Do not fertilize swale plantings. (See "Fertilization", pages 25 & 26, for recommendations.)
- Mulch mow all turf areas once per month.
- Add new mulch to beds where the mulch depth has been reduced to less than 2 inches thick. Mulch not required where shrubs or groundcover completely hide the soil surface from view.
- Prune shrubs as needed to maintain proper shape (natural, touching, not sheared except where specified in pruning schedule).

March:

- * Mulch mow all turf areas once per month.
- * Fertilize all landscape areas except for bioswales and bioretention areas. The fertilization of shrubs/groundcover areas may be eliminated when the plants reach maturity or completely fill the planters, without space between them. Written authorization from the owner's representative is required before the fertilization may be eliminated from the required work.
- Submit receipts to owner's representative as proof of fertilizer purchase.

April:

- * Mulch mow all turf twice per month.
- * Add new mulch to planters where the mulch depth has been reduced to less than 2 inches thick. Mulch not required where shrubs or groundcover completely hide the soil surface from view.
- * Flush out irrigation systems as needed, run and check for proper operation of each valve zone. Test sensors (rain, soil, or weather sensors).
- Remove and clean irrigation line WYE filter screens.
- Clean or replace plugged sprinkler nozzles. Replace plugged drip emitters.
- Replace irrigation controller program back-up batteries.

May:

- * Mulch mow all turf areas weekly.
- * Turn on irrigation system, run and visually inspect for proper zone coverage. Set ET-based, weather or soil sensor-based, or seasonal programs to adjust irrigation up in July-August, and down for May-June and September.
- * Clean Permeable Paving

June:

- Mulch mow all turf areas weekly.
- Prune spring & winter-flowering shrubs as needed to maintain proper shape (natural, touching, not sheared except where specified in pruning schedule).

July:

- Mulch mow all turf areas weekly.

August:

- Mulch mow all turf areas weekly.

September:

- Mulch mow all turf areas weekly.
- Aerate, fertilize and overseed all turf areas. Topdress areas as needed.
- Clean Permeable Paving

October:

- Mulch mow all turf areas weekly.

November:

- Inventory and inspect all plant materials Replace any dead or missing plants subject to the terms of the specifications.
- Mulch mow all turf areas twice per month.
- Have backflow preventer (on irrigation water supply) tested annually by approved plumbing technician.
- Turn off and prepare irrigation system for winter. Make sure backflow preventer is well-insulated or drained prior to first freeze. Blow out pipes using compressed air in areas where freezing could result in breakage. Drain drip irrigation lines as recommended by manufacturer. Any winter damage to irrigation system due to insufficient winterization shall be the responsibility of the contractor to repair.
- * Add new mulch where the mulch depth has been reduced to less than 2 inches thick. Mulch additions are not required where shrubs or groundcover completely hide the soil surface from view.
- Prune shrubs as needed to maintain proper shape.

December:

- Mulch mow all turf areas once per month.

* Asterisk indicate tasks that are priorities on Metro properties.
For maintenance information specific to bioretention features, see page 31 of this document and Metro Stormwater- http://www.nashville.gov/Water-Services/Developers.aspx

Note:
Check irrigation systems monthly during season when in use.

SECTION THREE

BartsTreeService.com

STOP TREE TOPPING

Topped trees are **NOT SAFER**

New growth is **WEAK** and **HAZARDOUS**

Topping is **UGLY** and **ABUSIVE**

Topping leaves trees open to **INSECTS** and **DISEASE**

Topping **STRESSES** and **STARVES** **the tree shortening it's lifespan.**

Topping is **EXPENSIVE** and **UNNECESSARY**

Plant the **RIGHT TREE** in the **RIGHT SPOT**

Hire a **CERTIFIED ARBORIST** for Crown Reduction or other recommendations

C. LANDSCAPE MANAGEMENT AREAS

C.1. Grounds Maintenance – all outdoor areas

Clean-up:

- Remove biodegradable landscape debris to a yard waste recycling facility, including turf clippings (limited to only those times when mulch mowing is not possible), leaves, branches, annuals, dead plant material, potting soil, etc. Acceptable facilities include composting facilities, topsoil producing facilities or other facilities which utilize yard waste for landscape purposes. No biodegradable material should be disposed of in garbage to land fill sites.
- Residents of Nashville can also dispose of brush and other landscape waste free of charge at **Bordeaux Mulch Facility,** 1400 County Hospital Road.
- All trash and sticks are to be picked up from lawn strips and bed areas prior to mowing.
- A weekly general clean-up program will be performed. The clean-up program shall include a review of all maintained areas for the removal of trash (paper, cans, bottles etc.) and landscape waste such as fallen sticks and limbs.
- All trash and landscape debris shall be removed and disposed of off-site.
- Dog and other animal waste should be bagged and deposited in trash receptacle so that it can not enter the stormwater system.
- Mulch is to be maintained clear of tree bases, building foundations and paved areas, and off utility covers.
- Debris shall not be carried onto patios, entryways or doorways.
- Debris deposited by typical weather occurrences will be cleaned up.
- Sweep patios and sidewalks at least weekly.

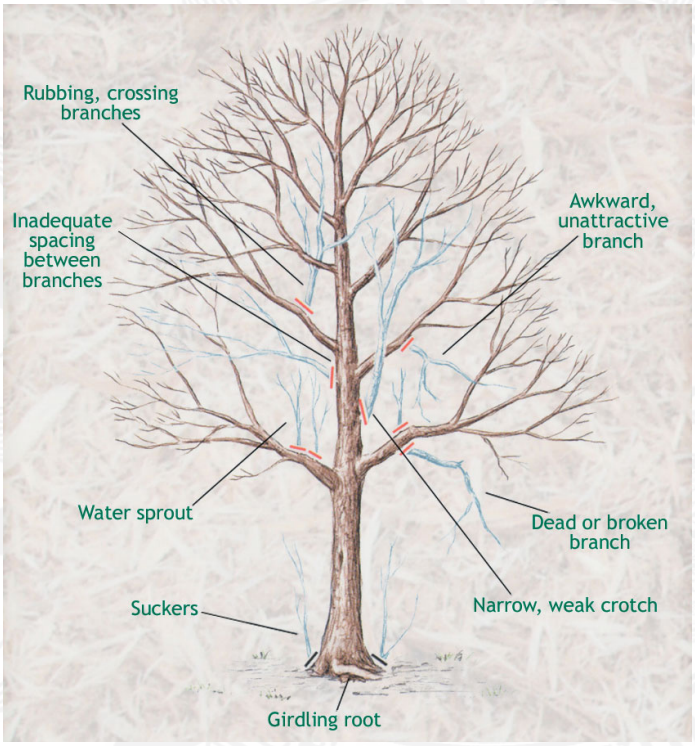
Fall leaf removal – September through January

- On a weekly basis remove leaves from lawn areas to prevent heavy build-up and damage to turf by smothering. A single layer of leaves may be mulch-mowed into the turf. Thicker accumulations should be removed.
- Leaves may be raked or shredded by mower and blown into shrub beds for mulch, or accumulated leaves will be raked and/or blown from lawn, plants, high maintenance bed areas and collected and removed from property and disposed of off-site.
- Residents of Nashville can also dispose of leaves free of charge at **Bordeaux Mulch Facility,** 1400 County Hospital Road.
- Sweep leaves from patio at least weekly, to avoid clogging paver pores.
- Never put leaves into stormwater drains. They can collect and block the system and create excessive nutrient loading of the water.

C.2. Pruning and Plant Care– Trees, Shrubs and Groundcovers

C.2.1 Trees

- Trees shall be maintained in a healthy, vigorous growing condition, free from disease and large concentrations of pests.
- Prune trees only to remove dead, diseased, broken, dangerous, or crossing branches, and as required as follows:
- Prune in accordance with generally accepted standards for proper pruning by a certified arborist.
- Discard all tree trimmings off-site using a legal method such as Metro Brush collection for residential waste http://www.nashville.gov/Public-Works/Neighborhood-Services/Yard-Waste-Composting/Brush-Yard-Waste-Collection/Brush-Routes.aspx or a licensed landfill will accept both residentrial and commercial trimmings.
- Trees found to be dead or missing due to lack of maintenance, shall be replaced with trees of identical or approved species at the landscape maintenance contractor's expense. Replacement trees shall be approved for size and quality by the owner's representative before planting.
- If tree stakes are necessary, remove them after one growing seasons. Check tree ties to adjust and loosen as needed after the first growing season. Remove stakes from



Proper Pruning for Safety and Longevity

site and dispose of by a legal method. Recycle used stakes.

- Once a year as needed, prune all trees to encourage a high-branching structure. Remove all non-structural branches between the ground and a point two-thirds the tree's total height (for tall trees don't remove branches higher than 20 feet [20'] above the ground). Exception to the above: trees planted for screening purposes, shall not be pruned except as needed to remove dead, diseased, broken, dangerous, or crossing branches.
- Do not remove more than one-fourth of the canopy at any one time.
- All sucker growth from trunk and base of trees shall be removed monthly or as required up to twelve feet (12') from the ground to maintain a clean appearance.
- The cutting blades on pruning shears, clippers, blades, saws, etc. shall be sterilized after pruning each tree to minimize the possibility of spreading disease. When pruning trees known or suspected to be diseased, cutting blades shall be sterilized (with 10 percent bleach solution or other approved) after each cut.
- A vertical clearance of 114 inches (9'-5") is required above all parking spaces. A vertical clearance of eight feet (8') is required above all walkways and fourteen feet (14') over streets. Trim trees to remove all limbs within these areas keeping in mind the two-thirds rule.

An excellent publication on pruning is UT Extension PB1619 - Best Management Practices for Pruning Landscape Trees, Shrubs and Groundcovers

Vegetation in a designated water quality buffer should not be pruned. Please see Section 6.9.6 of Metro's Stormwater Management Manual or contact MWS at 615-880-2420 for additional information.

http://www.nashville.gov/Water-Services/Developers.aspx

C.2.2 Shrubs

- Shrubs shall be kept in a healthy, vigorous condition, free from disease and large concentrations of pests.
- Shrubs shall be pruned monthly as needed to remove branches that are dead, broken, extending beyond the face of curbs or sidewalks. Allow the shrubs to grow in their natural form to their mature sizes.
- Shrubs uniformly planted as a sheared hedge shall be pruned so as to encourage a continuous planting where individual plants are not identifiable.
- Prune to encourage a dense, continuous planting, with a natural shape that is wider at the base and narrower at the top and branches reaching fully to the ground.
- All other shrubs shall be pruned only as required for safety, visibility, and plant health, and allowed to develop into the natural shapes expected of the plant variety. Do not shear shrubs into topiary (shapes) unless specifically instructed.
- Allow shrubs two (2) months to rejuvenate following a hard frost prior to pruning or replacing.
- Any shrub found to be dead or missing shall be replaced with plant material of identical or approved species at the landscape maintenance contractor's expense, unless the loss was due to excluded damage.
- When pruning shrubs known or suspected to be diseased, the cutting blades shall be sterilized after each cut.

C.2.3 Vines

- Vines shall be maintained as per "Shrubs" above. They shall be encouraged to climb in appropriate areas (example: designated by support wires around the southeast corner of the building). They shall be pruned to keep free from window recesses and shall climb no higher than the first story (12').

C.2.4 Groundcovers

- Groundcover shall be maintained in a healthy, vigorous growing condition.
- Any groundcover found to be dead or missing due to lack of maintenance, shall be replaced with plant material of identical species at the landscape maintenance contractor's expense.

SECTION THREE

- Keep groundcover trimmed to edge of sidewalks, curbs, and paved areas on a monthly basis or as needed. Do not create vertical edges when pruning groundcover. Cut the edges at an angle /--\ for a more natural appearance and healthier plants. Prune so groundcover just overlaps adjoining paving; an open mulch strip here allows weeds to take hold and trash to accumulate.
- If regular foot traffic through a planter is preventing the groundcover from reaching full coverage of the soil, contact the owner's representative to discuss options for redirecting the foot traffic. Consider installing pavers, stepping stones, a concrete walk, a gravel path, and/or barriers to redirect pedestrians.

C.3. Fertilization - Trees, Shrubs, Vines and Groundcovers

- To prevent runoff of nutrients, do not fertilize plantings in bioswale and bioretention areas.
- Fertilizers shall be either organically derived or slow-release synthetic products, to minimize water pollution and feed plants over a longer period of time.
- Granular slow release or organic fertilizer shall be 5-5-5 formulation or similar, applied per label rate for plant type. Water immediately after applying to move the fertilizer into the soil and wash the fertilizer off of plant surfaces.
- When applying granular fertilizers to drip-irrigated areas, the fertilizer must be washed in by hand or rainfall before turning on the drip system. Running the drip system immediately after application will push the fertilizer away from the emitters, resulting in a high concentration of fertilizer at the edge of the wetted zone. This highly-concentrated fertilizer can kill or damage plants. It is recommended that granular fertilizers be applied to drip-irrigated areas only in early spring, just prior to a moderate rainfall.

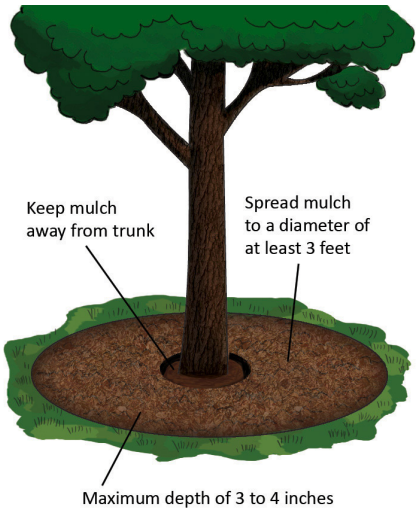
C.4. Mulch - Trees, Shrubs, Vines and Groundcovers

- Maintaining a deep layer of mulch greatly reduces the labor and materials needed to control weeds, reduces water use, and helps the plants stay healthy.
- Add additional mulch regularly to maintain a layer no less than 2 inches deep or higher than 4 inches at all times in shrub beds, tree rings, and beds where plants have not yet closed in over soil surface. Decomposition of organic mulch is considered normal wear and tear, and replacement of decomposed mulch is required seasonally. Mulch is not required in areas where plant foliage completely covers the soil surface, such that the soil is not visible through the foliage. Any mulch found outside plant beds shall be returned to the plant beds on a weekly basis.
- Mulch shall be uniform in color and appearance, and free of weeds, sticks or trash. Mulch may be decomposed hardwood, pine straw or leaves. When replacing, use a mulch product that is similar in appearance to that already at the site.

C.5. Turf Care

C.5.1. Mowing - Turf

- Mowing schedule: Mow weekly during active growth periods (April-November) and at least once a month during winter. Keep mower blades sharp.
- Clippings should always be left on lawn areas ("mulch-mowing" or "grasscycling"), except if this will create a large surface buildup, for instance if saturated soft soils have prevented mowing for several weeks in spring and the grass is very tall. Grasscycling returns about 2 lb. nitrogen per 1000 sq. ft. per year, and improves resistance to drought damage and weed invasion.
- Modern "mulching" mowers are preferred because they chop clippings finely and blow the resulting mulch down to ground level, leaving a clean surface which is preferable, especially around building entrances where track-in can be a problem. Effective mulching requires about 20 percent more engine power, and it may be necessary to slow down in heavy areas or wet weather to get the best mulching

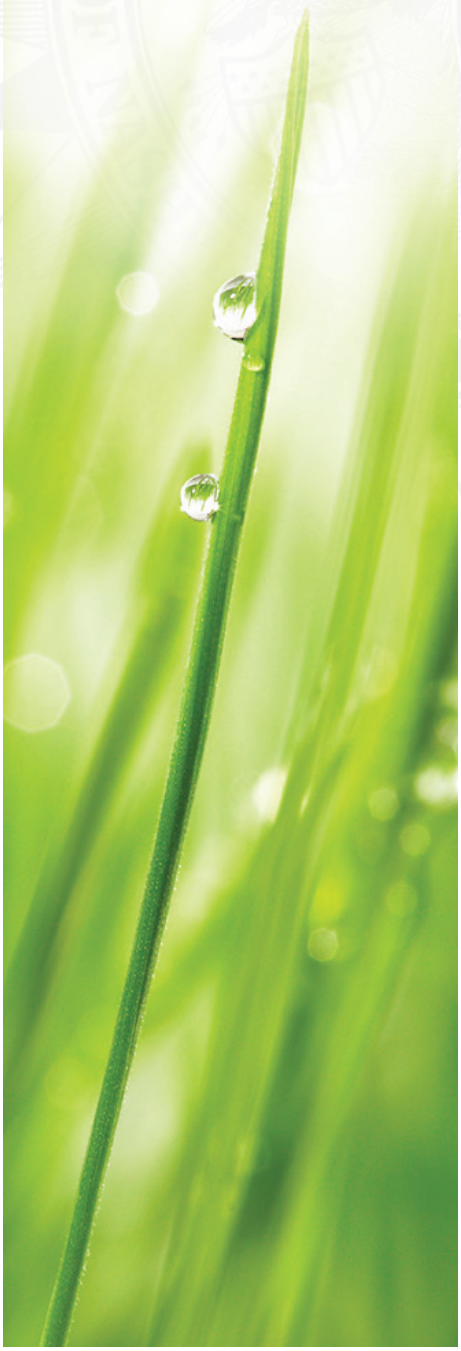


Wyoming Tree Care

TN Gardner

NO MULCH VOLCANO

More is not always better.
Mulch too deep creates a barrier for water and air getting to the roots.
3 inches-4 inches is ideal and will hold moisture longer than soil.



results. For these reasons, equipment that converts easily from mulching to side-throw (leaving clippings on surface) is the most adaptable to varying conditions and mowing schedules.

- Mowing height: 2 to 4 inches high depending on the species of grass.

Recommended Mowing Heights

Kentucky Bluegrass 2-3 inches
Tall Fescue 2-3 inches
Perennial Ryegrass 2-3 inches
Fine Fescues 2-3 inches
Bermuda grass 0.5-1.5 inches
Zoysia grass 1-2 inches
Buffalo grass 3-4 inches

- Mowing frequency: to cause the least stress on the grass plant, mow often enough to remove only one-third of the blade length (e.g., when the grass is 5 inches high mow it down to 4 inches). Also, mow un-irrigated summer-dormant turf regularly enough to remove weed seed heads before they mature. Start mowing in late winter as soon as grass begins to grow. On most lawn areas these rules will result in mowing every 5-7 days through the height of the spring growth spurt, tapering to weekly on irrigated summer lawn or 10 days to 2 weeks on dormant lawn, weekly through the fall growth spurt, and once a month during winter. Avoid over-fertilization and soluble "quick release" fertilizers to reduce mowing frequency.

C.5.2. Fertilization - Turf

- Natural organic fertilizers or "bridge" (organic plus slow-release synthetic) fertilizers shall be used. Soluble fertilizers, though less expensive, wash off site, volatilize, require more frequent application, and are toxic to beneficial soil life, so tend to be more expensive over time.
- Mid to late fall applications are the key to building carbohydrate reserves in the grass root system over the winter. Early spring applications should be avoided because they promote rapid top growth (requiring more mowing) and can exhaust stored nutrient reserves. Spring applications should be in late spring.

C.5.3. Aeration and De-thatching - Turf

- While aeration is most important on high-use areas (such as building entrances) any area should be considered for annual or more frequent aeration if it shows signs of thin turf, weed invasion, poor irrigation penetration, or soil compaction.
- Thatch buildup (beyond the 1/2 " that is healthy) is usually a sign of over-fertilization, over use of broadcast pesticides, over-watering, soil compaction, or other causes of diminished soil biota to break down thatch. Excess thatch prevents water penetration and promotes shallow rooting. Good maintenance practices will generally prevent thatch buildup, but where present it should be reduced by regular aeration or a vertical mowing (de-thatching), followed by adjusting cultural practices to prevent recurrence.

C.5.4. Overseeding - Turf

- In addition to aeration, spring or fall lawn renovations should include overseeding of thin or weed infested areas, or entire areas subject to heavy wear. This is a key weed control practice.
- Select certified seed appropriate for the site (perennial rye for sport lawn, rye and fescue blends for general lawn: contact the Cooperative Extension Service for site-adapted varieties, or buy from a reputable local supplier).
- Generally overseeding is practiced after aeration and before topdressing. A slice-seeding machine allows seed to be placed in the ground at the end of the dry season to await fall rains, and greatly improves seed germination and survival.

C.5.5. Topdressing - Turf

- After aeration and overseeding, high-use or worn lawn areas should be topdressed in spring or fall for greatest improvement.
- General lawn should be topdressed with pure compost or a compost-sand mixture, 1/4 to 1/2 inch thick, to improve both drainage and soil fertility. Use weed-free mature compost from a reputable supplier, screened to 3/8 inch minus particle size. Dragging or raking after application can help get compost down into the aeration holes and break up aeration cores and compost clumps.
- Take soil plugs annually to verify that the compost is being incorporated into the soil profile below the aeration depth by earthworms and other soil biota, rather than accumulating on the surface where it could limit water infiltration. (This is a possible problem in cases of low soil biota due to overuse of fertilizers or pesticides, poor drainage, or conditions of acidic or compacted soils. Correct these problems to improve compost incorporation.)

IPMPro

The Integrated Pest Management mobile app for landscape professionals has been developed. It includes major horticultural practices and disease and insect recommendations.

IPMPro will streamline pest management decision-making, employee training, and will make complying with state pesticide record keeping regulations easy.

The mobile app is available for iPhone, iPad, and Android.

http://www.ipmproapp.com

D. INTEGRATED PEST (WEED, INSECT, AND DISEASE) MANAGEMENT

Definition: "Integrated Pest Management, or IPM, is an approach to pest control [weeds, insects, and diseases] that uses regular monitoring to determine if and when treatments are needed, and employs physical, mechanical, cultural, and biological tactics to keep pest numbers low enough to prevent intolerable damage or annoyance. Least-toxic chemical controls are used as a last resort."

Daar, Olkowski & Olkowski: IPM Training Manual for Landscape Gardeners, 1992

D.1. Weed Control for Trees, Shrubs, Vines and Groundcovers

- Weeds in planted areas, sidewalks, curbs, gutters, or pavement shall be removed or killed weekly as the weeds emerge. Weeds shall be removed (not just killed) if they are larger than 2 inches (5 cm) in height or diameter. Dispose of weeds off-site. The cost of all weed control work shall be included in the contract price for landscape maintenance. Regular maintenance of the mulch layer will help minimize weeds in shrub and groundcover areas.
- Contractors are strongly encouraged to use Integrated Pest Management techniques for controlling weeds. Techniques include mulching, pulling, allowing plantings to grow densely and shade ground, heat and hot water controls. If herbicides must be used, choose the least toxic available and spot apply on weeds. Pre-emergent herbicides are not encouraged – maintaining a proper mulch layer combined with mechanical weeding is as effective.

D.2. Weed, Insect, and Disease Control for Turf

- Weed invasion can be effectively prevented or reversed by growing dense lawn, through the above recommended practices. Tolerate some broad-leaved plants in lawn areas. Identify problem (invasive) weeds and target only those species.
- Control weeds in turf by removal where practical (long-handled weed-pullers do this quickly), and remove them regularly before they go to seed. If weeds have over-run an area, spot-application of the least-toxic herbicide is permitted.
- No broadcast herbicide or "weed-and-feed" products may be applied.
- Moderately fertilized turf on well drained organic-rich soils rarely has serious disease problems. Correcting poor soil conditions or cultural practices (like over-watering or over-fertilization) will prevent diseases.

D.3. General IPM Steps and Methods

IPM Steps Include:

1) Prevention first: plant vigorous, pest-resistant, site-adapted varieties. Plan cultural practices to minimize pests (watering, mulching, pruning, etc.).
2) Identify/know the pest (weed, etc.) life cycle.

3) Set action thresholds – tolerate some damage.
4) Monitor regularly (keep records of monitoring).
5) When pests exceed threshold, use control method with the least non-target impact. (Try cultural, physical, or biological methods first. As a last resort, use spot applications of least toxic chemical.) Only treat when the pest is most vulnerable and its natural enemies are in their least susceptible life stage.
6) Keep records of control methods and results to evaluate, and adapt cultural practices.
7) Replace problem plants with more pest, disease, and weed-resistant varieties.

D,4, Weed Control Methods – General Guidelines:

- Crowd out weeds with dense healthy plantings, ground covers and shade canopies.
- Accept a few weeds – target the problem ones.
- Mulch beds in fall, winter, or early spring.
- Control weeds before they go to seed.
- Hoe, pull, mow, or till (mulch makes hoeing easier).
- Don't over-fertilize – it promotes weeds and pests.
- Spot apply the least-toxic chemical or cut-and-paint stems with systemic herbicides to minimize non-weed impacts.
- If a pesticide must be used, it should only be applied by a licensed pesticide applicator (including users of "weed & feed," or even low-risk herbicides like vinegar) who is licensed by State law, see http://www.tn.gov/agriculture/regulatory/aip.shtml

E. ANIMAL CONTROL

Under Metro Nashville ordinance 8.20.170 it is illegal to kill or attempt to kill any bird, game or non-game (except English sparrows), squirrels or any other animal, in any of the public parks (including the Custom House Park and the Capitol Hill Park) or in any of the cemeteries, public or private, within the urban services district.

dailymail.co.uk

It is critical that animals be positively identified; all federal, state, and local regulations be followed; and all products be used only according to their labeled directions.

There are a few things you can do to minimize unwanted animals such as eliminate standing water and areas in which the pest animals can feed, keep trash cans covered and areas clean and never feed pest animals.
Some remedies specific to birds are:

- Add spikes or sticky glues to ledges where pest birds roost.
- Clean gutters to prevent standing water.
- If pest birds are feeding on the food in feeders set out for desirable birds, try changing the type of food used or stop using feeders during warm weather.
- Seal openings through which the smaller pest birds can enter. Sparrows can enter through gaps as small as 3/4 inch, and starlings through one-inch openings.
- Block vent, eave, and loft openings with plywood, 1/4-inch wire mesh, or netting.
- Netting – attaching nylon or plastic netting to the bottom of rafters will close off this area to birds, who are attracted to such areas for nesting and roosting.
- Other methods include repellents, live traps, nest removal.

Roosting-

- Trim trees away from structures. Thin out limbs of trees to reduce cover and make roosting there uncomfortable. Thinning doesn't need to be dramatic to be effective.
- Use devices designed to scare birds; some of these utilize ultrasonic sounds, bird distress calls, automatic gas explosions, flashing lights, or shakers that disturb the roosting vegetation. Keep your bird repellents moving around so birds don't get used to them.
- Make the area undesirable as quickly as possible when you spot unwanted roosting. Birds are more willing to leave a roost that they haven't used for long.
- Be patient. It usually takes five to seven nights or more of continuous effort for bird repellent programs to work.
- Birds scare more easily when they are flying and are less likely to be frightened when secure in their roost. Begin sound frightening techniques when birds are first coming to roost. Quit frightening efforts after dark so the birds will not get used to the sounds.

KENTUCKY BLUEGRASS LAWN NEEDS ABOUT 1.5” OF WATER PER WEEK		
MAY -	1.2”	Per Week
JUNE -	1.5”	Per Week
JULY -	1.5”	Per Week
AUG -	1.2”	Per Week
SEPT -	1.0”	Per Week
OCT -	0.67”	Per Week

F. IRRIGATION

F.1 All Areas

- Irrigation system should be managed by trained staff or irrigation specialist.
- Monitor the moisture levels with moisture meters around all plants including, but not limited to trees, lawn, shrubs, perennials, groundcovers and annuals.
- Report problems (including brown spots or saturated areas) to on-site management during normal maintenance visits.
- Fix irrigation system leaks and broken or misdirected heads as needed on every site visit.
- Hand water any ornamental plants not under irrigation as needed.
- Adjust spray heads in shrub beds as plants grow and block spray pattern. Relocate or replace heads with higher spray pop up or put on risers.
- Hire a certified landscape irrigation auditor to evaluate systems performance efficiency in precipitation rates and distribution uniformity.

F.2 Spring start-up

- Prior to system start up, have the backflow checked by a licensed backflow inspector.
- Open the main valve(s), inspect and adjust all sprinkler heads, re-program and check battery backup in controller, and troubleshoot the entire system.
- Test sensors (rain, soil moisture, weather) and zone coverage while running.
- Set ET-based, seasonal, or weather–based manual or automatic programs. Post spring/summer/fall schedules (runtimes x days / zone) and train staff as needed to monitor through season.

F.3 Checks and repairs

- Once per month during activation inspect entire irrigation system. Irrigation inspections shall include the following:
- Activation of each zone to inspect for valve function, lateral breaks, damaged heads, coverage or anything else that would indicate any malfunction of the irrigation system.
- Adjust irrigation heads for proper coverage.

Activerain.com

Reduce water waste.
Adjust heads to eliminate overspray.

- Adjust automatic controller to establish frequency and length of watering periods for seasonal requirements and water restrictions.
- Runoff of water from irrigation systems onto streets, sidewalks, stairs, or into gutters is not permitted. Immediately shut down the irrigation system and make adjustments, repairs, or replacements as soon as possible to correct the problem.
- After repair, remove damaged head and let water run for a few minutes until dirt and debris is flushed.
- Do not over-water plantings. Use multiple-start times and short run times to prevent runoff. Drip systems should be left on for sufficient time to allow for saturation of the root zone. Shorter runs with drip irrigation do not provide sufficient water penetration for healthy root development. Avoid multiple-start times with drip systems if possible. Do not allow run-off from any irrigation.
- Rain sensors/weather sensor/soil moisture sensors: Install rain shut-off devices on all systems.
- Maintain the irrigation system, including cleaning of filter screens yearly or more often as needed, and flushing pipes.
- Drip irrigation systems need periodic flushing to remove sediment. Systems shall be flushed at least once a year. Open ends of drip lines and run for at least 15 minutes at full flow to flush. It may be necessary to install flush outlets in order to flush the drip system.
- Watch for leaks and misting from sprinkler heads. Misting may indicate high water

GREEN ROOF INCENTIVE

Metro Nashville has a Green Roof Ordinance to give monetary credit up to $500,000 for installing Green Roofs within the combined sewer area.

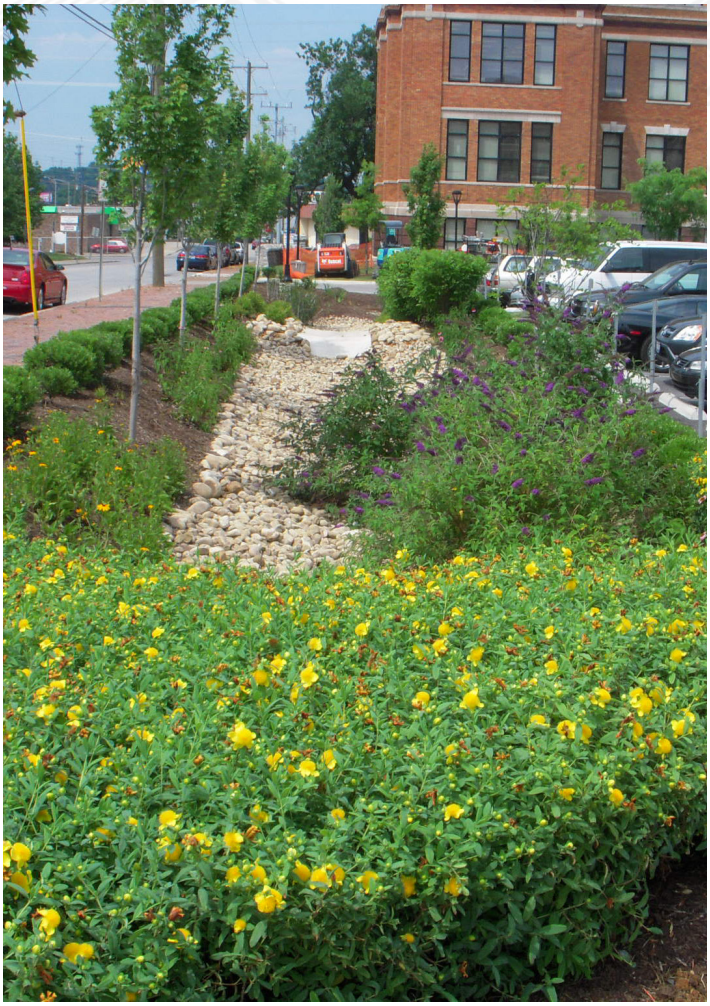
http://www.nashville.gov/Water-Services/Developers/Low-Impact-Development/Green-Roof-Rebate.aspx

pressure and may need a pressure regulator. Pressure regulator heads are one option or install regulator at water meter or valve box.

- Heads that are on the bottom of a slope may weep and cause erosion. Install check valves or heads with built in check valves where appropriate.

F.4 System Repair

- Regardless of the cause of damage, take immediate action to prevent further damage by shutting off the damaged part of the irrigation system and commencing with hand watering as needed. The following items are considered to be minor repairs:
  - damaged or clogged sprinkler nozzles,
  - adjustment of sprinkler patterns or arcs,
  - adjustment of sprinkler position (raise, lower, or straighten sprinkler head),
  - replacement of clogged, broken, or missing barbed-style drip emitters,
  - replacement or repositioning of drip distribution tubing smaller than 1/2 inch or 15 mm diameter.
- Any replacement of irrigation system components shall be made with materials of the same manufacturer and model as the original equipment.
- All repairs to the system shall be identical to the original installation, unless approved in advance by the owner's representative. If a change to the installation will result in lower future maintenance costs, less frequent breakage, or an increase in public safety, request authorization to make the change from the owner's representative.



Case study of Bioswales at Metro's Richard H. Fulton Campus

- For safety, do not install sprinklers on risers above the ground level, even if the risers are flexible. Always use spring-operated, pop-up style, sprinkler heads. Sprinkler heads are available with pop-up heights up to 12 inches above ground level. If the existing sprinklers are mounted on above-ground risers, the replacements shall be pop-up type sprinklers. No exceptions.
- Annually submit recommendations for changes to system that would improve water efficiency while meeting the plants' needs.

F.5 Winterization

- Completely drain the sprinkler system (blowout) to prevent freeze damage to underground pipes and sprinkler heads. Close all valves and shut down the controller(s) for the winter.

G. SPECIAL LANDSCAPE AREAS

G.1 Street Trees and Right-Of-Way plantings

- These areas have additional stress of vehicular, pedestrian and dog traffic and are most often not irrigated. To avoid compaction and to prolong tree life, it is necessary to keep underplantings vigorous and healthy. If low shrubs or groundcovers are damaged, replace them immediately to prevent further damage.

G.2 Green Roof

- Weeds may be introduced by birds or wind-dispersed seeds. This area will require low but ongoing maintenance after it is established, and may need frequent weeding until desired vegetation covers the planted surface.
- Green roofs are exposed to extremes of wind, sun, and temperature. The green roof planting plan uses hardy, drought-resistant plants, but some initial watering will be required in this harsh microclimate. Manual watering about every two weeks will be necessary during the first two summers after installation.

G.3 Bioretention Areas

- Swales and rain gardens, designed to capture and hold roof runoff, will not maintain optimal drainage rates if soils become compacted. Minimize foot traffic in this area, although occasional walking for maintenance is fine.
- In addition to preventing weeds, regular applications of mulch will maximize the swale's ability to capture and break down contaminants. In order to prevent runoff of excess nutrients, rain garden plantings should not be fertilized. Plant selection, a rich soil mix, and regular mulching should provide sufficient nutrients to plants in these areas.

G.4 Permeable Pavement

- Permeable pavement requires periodic maintenance to avoid getting clogged with debris over time. The rate of sediment deposition should be monitored and maintenance should be scheduled accordingly. Depending on the type of pavement, mechanical sweeping, vacuum sweeping, or pressure washing can be used to clean the pavement. See EPA- Stormwater Fact Sheet- Porous Pavement. Similarly, avoid using salt and sand on this area in the winter. In general, permeable pavement does not tend to accumulate ice since it does not hold puddles.
- Additional gravel may occasionally be necessary to refill the joints between permeable pavers. Gravel supplements are needed if the gravel channels drop more than 1.5inches below the paver surface.

G.5 Playgrounds

- All playground areas and equipment should be inspected for excessive wear, deterioration, and potential hazards. Frequency of inspections will depend on usage, age of equipment and climate. Annual inspection should be the minimum.
- All repairs and replacements of equipment parts should be completed following the manufacturer's instructions.User modifications, such as loose-ended ropes tied to elevated parts, should be removed immediately.
- Consult the manufacturer for maintenance schedules for each piece of equipment. Based on these schedules, a maintenance schedule for the entire playground can be created. This routine maintenance schedule should not replace regular inspections.
- Displaced loose-fill surfacing materials particularly in areas of the playground most subject to displacement (e.g., under swings and slide exits)should be raked back into place so that a constant depth is maintained.
- Proper depth levels can be facilitated by marking ideal surfacing depths on equipment posts.
- Records of all maintenance inspections and repairs should be retained.

H. OPERATIONS AND STAFF TRAINING

Although a landscape department operations must be worked out on a case-by-case basis, it will need regular training in areas such as safety, procedures and equipment. This type of staff support should be included in planning and budgets.

ENDNOTES:

1. Sustainable Sites Initiative (SITES) http://www.sustainablesites.org
2. Erosion Control in the Landscape - http://www.lowes.com/cd_Controlling+Erosion+in+the+Landscape_1259068825_
3. Soil for Urban Tree Planting, E. Thomas Smiley, Ph.D.- Bartlett Tree Research Laboratories Technical Report
4. SULIS-Sustainable Urban Landscape Information Series - http://www.sustland.umn.edu/index.html
5. Preparing Landscape Management Plans for Seattle Green Factor Compliance- Seattle Green Factor- Seattle Department of Planning and Development
6. Controlling Pest Birds-What Works and What Doesn't, Lisa Jo Lupo - http://pestcontrol.about.com/od/diypestcontrolprevent/a/Controlling-Pest-Birds.htm

RESOURCES

METRO GOVERNMENT:
Metro Purchasing - http://www.nashville.gov/Finance/Procurement/iProcurement-and-iSupplier.aspx
Metro Contactor lists-Construction, Design and Small and WBE list available at:
iProcurement System - http://www.nashville.gov/Finance/Procurement/iProcurement-and-iSupplier.aspx
Nashville Open Space Plan Davidson County www.nashville.gov/Portals/0/SiteContent/Sustainability/NashvilleOpenSpacePlan.pdf
Metro Stormwater LID - http://www.nashville.gov/Water-Services/Developers/Low-Impact-Development.aspx
Zoning Landscape - http://library.municode.com/index.aspx?clientId=14214
Metro Development Services - http://ds.nashville.gov
Metro Health Dept. Septic System Approval - http://www.nashville.gov/Health-Department/Environmental-Health/Septic-and-Sewage-Disposal-Systems.aspx
Metro Historic Zoning Comm - http://www.nashville.gov/mhc
Metro Planning Comm - http://www.nashville.gov/mpc
Metro Codes - http://www.nashville.gov/Codes-Administration.aspx
Metro Public Documents - http://www.nashville.gov/Codes-Administration/Codes-Administration/Publications-List/General-Publications-List.aspx
Metro Tree Canopy Assessment - http://www.nashville.gov/Public-Works/Community-Beautification/Tree-Information/Inventory-and-Canopy-Assessment.aspx
Metro Tree planting in ROW - http://www.nashville.gov/Public-Works/Community-Beautification/Tree-Information/Planting-in-the-Right-of-Way.aspx
Clean Water Infrastructure- http://www.cleanwaternashville.org
Mayor's Office of Environment and Sustainability - http://www.nashville.gov/sustainability
SOCKET- Nashville Unplugged - http://goyonder.com/socket

STATE GOVERNMENT:
TN Ag Dept. - http://www.tn.gov/agriculture/index.shtml
TDEC -TN Dept. of Energy and Conservation - http://www.tn.gov/environment
U.T. Soil, Plant and Pest Center, Ellington Agricultural Center - http://soilplantandpest.utk.edu

FEDERAL GOVERNMENT:
EPA's Open Space Development - http://www.epa.gov/owow/NPS/ordinance/openspace.htm

SPECIFICATIONS:
MasterFormat - http://www.masterspec.com/structural_civil_landscape_specifications.aspx

PLANTS:
USDA; A Management Guide for Invasive Plants in Southern Forests- http://www.srs.fs.usda.gov/news/456
TVA- Riparian Restoration - http://www.tva.gov/river/landandshore/stabilization/index.htm
TN-EPPC-TN Exotic Pest Plant Council - http://www.tneppc.org/pages/landscaping
(ANSI) 2004 American Standard for Nursery Stock - http://www.anla.org/index.cfm?area=&page=Content&categoryID=260
ANSI A300 (Part 6)-2012 Planting and Transplanting - http://www.tcia.org/business/business-resources/ansi-a300/part-6
NES Tree Trimming - http://www.nespower.com/vegmgmt.html

URBAN FORESTRY:
Human Dinemsions of Urban Forestry and Urban Greening - http://www.naturewithin.info/index.html
Pacific SW Research Station - http://www.fs.fed.us/psw/programs/uesd/uep
USDA Urban Forests and Climate Change - http://www.fs.fed.us/ccrc/topics/urban-forests

LOW IMPACT DEVELOPMENT:
Rain Gardens for Nashville - http://www.raingardensfornashville.com
Metro Stormwater LID - http://www.nashville.gov/Water-Services/Developers/Low-Impact-Development.aspx
Green Infrastructure Design - Green Infrastructure Design using Low Impact Development
EPA- LID - http://water.epa.gov/polwaste/green
LEED - https://new.usgbc.org/leed/
SITES - http://www.sustainablesites.org
Metro Nashville Interactive LID site map - http://maps.nashville.gov/LID_Sites

LOW IMPACT DEVELOPMENT: continued

Case Studies - http://www.asla.org/stormwatercasestudies.aspx
Greenroofs - http://www.greenroofs.org
Sustainable communities - http://www.cnt.org
NYC Green Infrastructure Plan - http://www.nyc.gov/html/dep/html/stormwater/nyc_green_infrastructure_plan.shtml
Portland OR Environmental Services - http://www.portlandoregon.gov/bes/34598
ASLA - http://www.asla.org/ContentDetail.aspx?id=24076
EPA - http://www.epa.gov/owow/NPS/lid/section438

STREET DEICING
Maryland Dept of Enviroment- http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/SedimentandStormwaterHome/Documents/www.mde.state.md.us/assets/document/WINTER_2.pdf
Milwaukee Riverkeeper - http://milwaukeeriverkeeper.org/content/winter-recipe-low-salt-diet-its-our-rivers
Chesapeake Stormwater Network - http://chesapeakestormwater.net/2009/01/winter-road-salt-and-the-chesapeake-bay
Stormwater Journal - http://www.stormh2o.com/SW/Articles/Salt_No_Easy_Answers_8162.aspx
Street Deicing Storage & application:
EPA: http://www.epa.gov/safewater/sourcewater/pubs/fs_swpp_deicinghighway.pdf
Michigan: http://www.semcog.org/uploadedFiles/Programs_and_Projects/Water/Stormwater/Municipal_Training/Streets_and_Parking_Lots/Road Salt Application.pdf

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APPENDIX

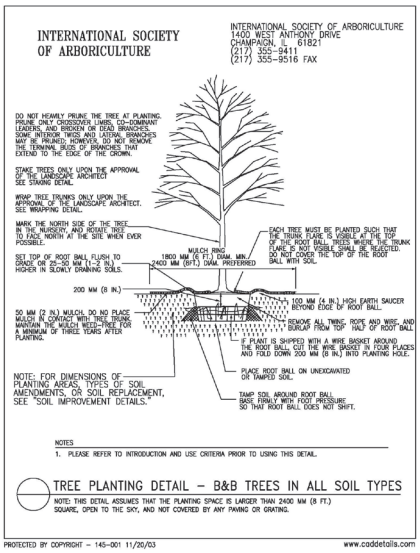
SECTION FIVE

Landscape Maintenance Calender

Numerals represent number of Service Visits

TASK Times/mo	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Landscape Beds													
Prune		1				1					1		3
Mulch		1									1		2
Fertilize		1											1
Weed				1	1	1	1	1	1	1	1		8
Lawn													
Mow & clean-up	1	1	1	2	4	4	4	4	4	4	2	1	32
Fertilize			1						1				2
Overseed									1				1
Airate									1				1
Irrigation													
Activate				1									1
Winterize											1		1
Inspection				1	1	1	1	1	1	1	1		8
Planters													
Mulch				1									1
Overall													
Prune trees	1												1
Fertilize trees		1											1
Replacement									1				1

Installation Details



Native Plant List for Green Infrastructure Design							
TREES		Drought Tolerant-Flood Tolerant				Flower	
Latin Name	Common Name	DT-FT	Light	Moisture	Notes	Color	Height
Acer rubrum	Red Maple	DT-FT	sun-shade	dry-wet	Fall color	Red	50-70'
Acer saccharum	Sugar Maple	DT	sun-pt shade	moist	Fall color		50-75'
Alnus serrulata	Tag Alder		sun-pt shade	moist		Yellow	10-20'
Amelearnchier canadensis	Serviceberry	DT	sun-pt shade	moist-wet	Edible berries	White	15-25'
Aesculus flava	Yellow Buckeye	FT	sun-pt shade	moist		Yellow	60-80'
Asimina triloba	Paw Paw	FT	sun-pt shade	moist	Edible fruits	Marroon	15-30'
Betula nigra	River Birch	DT-FT	sun-pt shade	moist-wet	Exfoliating bark		40-70'
Carpinus caroliniana	Am. Hornbeam, Musclewood, Ironwood	DT-FT	sun-pt shade	moist		White	40-60'
Carya aquatica	Water Hickory	FT	sun-pt. shade	wet-moist			50'
Carya cordiformis	Bitternut, Swamp Hickory	FT	sun-pt. shade	wet-moist			50-75'
Cercus canadensis	Redbud	DT-FT	sun-shade	moist	Pea-like flowers, seed pods	Purple	20-30'
Chamaecyparis thyoides	Atlantic White Cedar		sun-pt. Shade	wet-moist	Evergreen		40-50'
Chionanthus virginicus	Fringetree	Ft	sun-pt shade	moist	Panicled, fragrant flowers	White	12-20'
Cladratis lutea	Yellowwood	DT	sun	dry-moist	Fall color	White	30-45'
Cornus florida	Flowering Dogwood	DT	part shade	moist	Red fruit, wildlife	White	15-30'
Cornus foemina	Swamp Dogwood		sun-pt shade	wet-moist		White	20-25'
Diospyros virgiana	Persimmon	FT	sun	moist	Colonizing,Edible fruit on female		35-40'
Fraxinus pennsylvanica	Green Ash	DT-FT	sun	dry-wet		Purple	50-60'
Ilex opaca	American Holly	DT-FT	sun-pt shade	moist	Evergreen	White	30-50'
Liquidambar styraciflula	Sweetgum	DT-FT	sun-pt shade	dry-moist	Spiny fruit		60-100'
Lirodendron tulipifera	Tulip Poplar	DT	sun-pt shade	moist	TN State Tree	Yellow	70-90'
Magnolia grandiflora	Southern Magnolia		sun-pt shade	moist	Evergreen	White	30-100'
Magnolia virginiana	Sweetbay Magnolia	FT	sun-pt shade	moist-wet	Evergreen	White	10-60'
Nyssa aquatica	Water Tupelo	FT	sun-pt shade	moist			80-100'
Nyssa sylvatica var. biflora	Swamp Tupelo	DT-FT	sun-pat shade	moist			40-50'
Oxydendrum arboreum	Ironwood		sun-pt shade	dry-moist	Wildlife	White	20-40'
Platanus occidentalis	Sycamore	DT-FT	sun-pt shade	moist	White mottled bark		70-100'
Quercus bicolor	Swamp White Oak	DT	sun-pt shade	moist-wet	Acorns		50-60'
Quercus shumardii	Shumard Oak	DT	sun	moist	Acorns		40-60'
Quercus michauxii	Swamp Chestnut Oak		sun-pt shade	moist	Acorns		40'
Quercus nigra	Water Oak	FT	sun-pt shade	moist	Acorns		70-80'
Quercus pagodafolia	Cherrybark Oak		sun-pt shade	wet-moist	Acorns		70-80'
Quercus texana (Q. nuttallii)	Nuttall Oak	FT	sun-pt shade	moist			65-100'
Rhamnus caroliniana	Carolina Buckthorn		sun	moist	Black fruit		15-30'
Salix nigra	Black Willow	FT	sun-pt shade	moist-wet	White catkins	Yellow	40-60'
Taxodium ascendens	Pond Cypress	DT-FT	sun-pt shade	wet-moist			50-80'
Taxodium distichum	Bald Cypress	DT-FT	sun-pt shade	wet-moist	Knees		50-80'

Native Plant Schedules

Click link to download planting details and specifications, published by the International Society of Arboriculture http://www.isa-arbor.com/education/onlineResources/cadPlanningSpecifications.aspx