

I. General Resources

Throughout this Resource Appendix, the underlined websites are available as hypertext links in the Microsoft Word version of this Resource Appendix available from Triangle J Council of Governments' website at www.tjcog.dst.nc.us.

The following resources include information relevant to most of the topics covered by these *Guidelines*. Resources targeted to specific *Guidelines* provisions are listed in Section II below.

- (A) The U.S. Green Building Council's *Green Building Rating System, Version 2.0, Leadership in Energy and Environmental Design* (March 2000), more commonly referred to as *LEED*[™], is available for downloading through the following website: www.leadbuilding.org. The *LEED Version 2.0 Reference Guide*, a very useful document giving detailed examples of strategies that can be used to achieve *LEED*[™] standards, can be ordered through this same website.
- (B) The *High Performance Building Guidelines* (April 1999) developed by the City of New York's Department of Design and Construction is a very useful document regarding design of public buildings. It is available for downloading from the following website: www.ci.nyc.ny.us/nyclink/html/ddc/home.html. The 144-page document can also be ordered for \$25.00 plus \$3.00 shipping charge and \$2.31 tax from City Store, 1 Centre Street, Room 2223, New York NY 10007, phone (212) 669-8246.
- (C) *Green Buildings: Commonwealth of Pennsylvania Guidelines for Creating High-Performance Green Buildings* (1999) contains good case studies and an excellent bibliography. It can be downloaded through the following website: www.gggc.state.pa.us. Also available from this website is an excellent free video regarding the development of the Commonwealth of Pennsylvania's Department of Environmental Protection building.
- (D) Johnson Controls, Inc. currently has under development a brochure describing expected return on investment from specific provisions listed in *LEED*[™]. The document describes whether each provision will increase or decrease capital costs or operating costs. It also categorizes the environmental, social, and economic return on investment for each provision. For further information, contact Paul von Paumgarten, Johnson Controls,

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Inc., Controls Group, PO Box 423, Milwaukee WI 53201-0423, phone (414) 274-4546 or e-mail paul.vonpaumgarten@jci.com.

(E) Other sustainable design websites:

(1) **Whole Building Design Guide:** www.wbdg.org

Good overall site for sustainable building information. Energy issues are covered extensively; it is quickly being updated for materials and other sustainable considerations. The site also has information on productivity.

(2) **Environmental Building News:** www.BuildingGreen.com

Includes material from EBN, excellent bibliography and other resources, calendar of events, ordering information for GreenSpec, Green Building Advisor, and other resources.

(3) **CREST:** www.crest.org

A great starting point for finding other resources.

(4) **U.S. Department of Energy:** www.eren.doe.gov/buildings

Software tools, case studies, and other resources.

(5) **Federal Energy Management Program, U.S. Department of Energy:** www.eren.doe.gov/femp

Information on alternative financing, case studies, training opportunities, and other resources. Includes *Greening of Grand Canyon* and other Greening reports and *Greening Federal Facilities Guide*.

(6) **Center of Excellence for Sustainable Development:** www.sustainable.doe.gov

Yet another website from the Department of Energy. This truly excellent site has a wealth of information on green building.

(7) **Green Building Challenge:** www.greenbuilding.ca

Information on an international effort to develop a method for assessing “greenness” of buildings.

(8) **U.S. Environmental Protection Agency:** www.epa.gov

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Includes information on statutes and regulations, indoor air quality, and environmental databases. (See, for example, Surf Your Watershed.) It has a design for the environment site at www.epa.gov/dfc.

(9) **General Services Administration/Planet GSA:** www.gsa.gov/planetgsa

Another government agency website. Includes case studies and resources.

(10) **GEO Green Building Resource Center:** www.geonetwork.org/gbrc

Resources and referrals to other internet sites, books, and professionals.

(11) **Sustainable Sources:**
www.greenbuilder.com/general/BuildingSources.html

Includes materials from the Austin, Texas, Green Builder Program and other resources.

(12) **Greenbuilding Discussion Group:** www.crest.org/sustainable/greenbuilding-list-archive

Active, wide-ranging discussion of green building issues and ideas.

(13) **Green Clips:** GreenClips@aol.com

A subscription “clipping service” for worldwide journals, newspapers, etc.

(14) **White House Publications/Executive Orders:**
www.pub.whitehouse.gov

Contains downloadable versions of all executive orders.

(15) **Rocky Mountain Institute:** www.rmi.org

Includes excellent resources and information, plus ordering information for publications. A particularly interesting publication downloadable from this site is *Greening the Building and the Bottom Line: Increasing Productivity Through Energy-Efficient Design*, by Joseph J. Romm and William D. Browning (1994).

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II. Resources Targeted to Specific *Guidelines* Provisions

(A) Quality Management

(1) The “Green Building Advisor” has helpful assistance on quality management techniques. See www.greenbuildingadvisor.com.

(B) Site

(1) The website for the NC Department of Environment and Natural Resources Division of Land Resources, which sets standards for erosion and sedimentation control, is www.dlr.enr.state.nc.us/eros.html.

(2) To determine whether land is enrolled in a county Use Value Program, contact the county tax assessor. A website link to these offices is www.ncinfo.iog.unc.edu/programs/NCAAO/assessor.htm.

(3) Information on land within county Agricultural Districts or with Class I or Class II soil can be obtained from the local Soil and Water Conservation District. For a list of offices, see the website www.enr.state.nc.us/DSWC/.

(4) For information on endangered species, see the US Fish and Wildlife Service listings at <http://endangered.fws.gov/wildlife.html#Species>.

(5) The State of North Carolina and FEMA have initiated a floodplain re-mapping program scheduled for completion in August 2001. For information, see the North Carolina Division of Emergency Management website: www.ncem.org.

(6) The US Environmental Protection Agency website on brownfield redevelopment is www.epa.gov/swerosps/bf/.

(7) The NC Department of Environment and Natural Resources Division of Waste Management website (<http://wastenot.ehnr.state.nc.us>) has links to information regarding hazardous waste, underground storage tanks, and Superfund sites.

(8) 40 CFR Parts 230-233 and Part 22 can be obtained from the following website: www.access.gpo.gov/nara/.

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(9) US EPA OSWER Directive 9610.17 can be obtained from the following website: www.epa.gov/swerust1/directi/od961017.htm.

(10) *ASTM Standard Practice E1739-95e1-Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* can be obtained through the American Society for Testing and Materials at the following website: www.astm.org.

(11) Watch the following website for images and descriptions of North Carolina native plants: www.ces.ncsu.edu/depts/hort/consumer/factsheets/

Other information on native woody plants is available from the following publications:

The Native Plant Primer, Carole Ottesen. 1995. New York: Harmony Books.

Eastern Forest, Ann Sutton and Myron Sutton. 1997. New York: Random House, Inc.

Gardening with Native Plants of the South, Sally Wasowski and Andy Wasowski. 1994. Dallas, Texas: Taylor Publishing Company.

Growing and Propagating Showy Native Woody Plants, Richard E. Bir. 1992. Chapel Hill, North Carolina: University of North Carolina Press.

Native Shrubs and Woody Vines of the Southeast: Landscape Uses and Identification, Leonard E. Foote and Samuel B. Jones, Jr. 1989. Portland, Oregon: Timber Press, Inc..

(12) For NC Department of Environment and Natural Resources Water Quality Division Best Management Practices, see the website at <http://h2o.enr.state.nc.us>.

(13) US EPA *Energy Star Roofing Guidelines* are available through the following website: www.epa.gov/appdstar/roofing/specs.htm.

(14) The NC State University Biological and Agricultural Engineering

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Department has established a permeable pavement demonstration site in Kinston, NC, and offers workshops on this topic. Contact Bill Hunt by phone at (919) 515-6751 or by e-mail at bill_hunt@ncsu.edu.

(15) *ASTM E408-71(1996)e1-Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques* is available through the ASTM website: www.astm.org.

(16) *IESNA Recommended Practice Manual: Lighting for Exterior Environments (RP-33-99)* is available from the Illuminating Engineering Society of North America website: www.iesna.org.

(17) For information on cultural landmarks, see the website of the State Historic Preservation Office in the North Carolina Department of Cultural Resources: www.hpo.dcr.state.nc.us.

(C) Water

(1) The Energy Policy Act of 1992 (P.L. 102-486 or H.R. 776) is a large document that can be viewed at the following website: <http://thomas.loc.gov/cgi-bin/query/C?c102:/temp/~c102m0gJmK>. Scroll down to Subtitle C, Section 123 for provisions regarding fixture performance requirements.

(2) For information on drought-tolerant plants, see “Xeriscape North Carolina,” which can be downloaded from the following website: www.ncsu.edu/ncsu/CIL/WRRI/uwc/publications.html.

(D) Energy and Atmosphere

(1) For information on energy modeling tools, see the US Department of Energy website at www.eren.doe.gov/buildings/tools_directory/.

(2) The Sustainable Buildings Industry Council produces software called “Energy-10” for designing integrated, low-energy buildings. It can be ordered through the Council’s website: www.sbicouncil.org.

(3) *ASHRAE Standard 90.1-1999 - Energy Standard for Buildings Except Low-Rise Residential Buildings* can be obtained from the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. website: www.ashrae.org.

(4) The US Department of Energy International Performance Measurement and Verification Protocol, Option B: Methods by Technology is available through the following website: www.ipmvp.org.

(5) The Center for Resource Solutions Green-E requirements are available from the Center's website: www.green-e.org/power/require.html.

(6) Information on the Low Impact Hydropower Certification Program can be obtained from the website of the Low Impact Hydropower Institute: www.lowimpacthydro.org/criteria.html.

(7) *Guidelines for Design and Construction of Energy Efficient County Facilities* (1995) are used by Wake County (NC) design teams when designing new and retrofitted County buildings. The document is available through the Wake County Facilities Design and Construction Department, phone (919) 856-6350.

(E) Materials and Resources

(1) Information on federal and state investment tax credits for rehabilitation of historic buildings is available from the website for the North Carolina State Historic Preservation Office: www.hpo.dcr.state.nc.us/tchome.htm.

(2) The Department of Environment and Natural Resources Division of Pollution Prevention and Environmental Assistance website has links to local government waste reduction offices and information on state and federal waste reduction resources, markets for recyclable materials, construction and demolition waste management, and recycled products. The website is www.p2pays.org.

(3) *WasteSpec: Model Specifications for Construction Waste Reduction, Reuse, and Recycling* contains model specifications for architects and engineers, plus a sample waste management plan, checklists, and information for contractors on waste reduction and recycling. It can be downloaded from the Triangle J Council of Governments website: www.tjcog.dst.nc.us.

(4) For information on how to obtain a 24-minute video case study on the new US EPA campus at Research Triangle Park, which includes a section on its construction waste recycling program, contact Jack Mor-

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gan, Administrative Assistant, Facility Development Staff, EPA New Campus Project, phone 919-541-1869.

(5) “Greenspec” is an *Environmental Building News* directory of environmentally-friendly building products. It can be ordered through the following website: www.greenspec.com.

(6) The California Integrated Waste Management Board publishes *Designing with Vision: A Technical Manual for Materials Choices in Sustainable Construction*, which can be downloaded from www.ciwmb.ca.gov/ConDemo/Pubs.htm.

(7) The REDI Database is a searchable database with up-to-date information on products and materials. It can be accessed through the following website: www.oikos.com.

(8) The US EPA Environmentally Preferable Purchasing Program has information and resources available from the following website: www.epa.gov/opptintr/epp/.

(9) For information on certified wood, see the websites of the Forest Stewardship Council of the United States (www.fscus.org) and the Certified Forest Products Council (www.certifiedwood.org).

(10) For an excellent overview of issues related to certified wood, see the Certified Forest Products Council brochure “Certified Forest Products: Solutions for Sustainable Design” available from the Certified Forest Products Council (above).

(11) For up-to-date information on North Carolina sources of certified wood, contact Warren Boyette, Program Head, Technical Development and Planning, Forest Management Section, Division of Forest Resources, NC Department of Environment and Natural Resources, phone 733-2162, ext. 246.

(F) Indoor Environment

(1) *ASHRAE 62-1999: Ventilation for Acceptable Indoor Air Quality* can be obtained through the following website: www.ashrae.org.

(2) An unpublished ASHRAE standard revision document, 62R-1998, developed by the ASHRAE Standards Project Committee on Indoor Air Quality, has

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much good reference material in its appendix. ASHRAE can be contacted at orders@ashrae.org or by telephone at 404-636-8400 or toll-free at 800-527-4723.

(3) *ASHRAE 129-1997: Measuring Air-Change Effectiveness* can be obtained through the following website: www.ashrae.org

(4) *Sheet Metal and Air Conditioning National Contractors Association IAQ Guideline for Occupied Buildings Under Construction* (1995), can be obtained through the following website: www.smacna.org

(5) *ASHRAE 52.2-1992: Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size* can be obtained through the following website: www.ashrae.org.

(6) For information on how to obtain the *Indoor Air Quality Facilities Operation Manual* for the new US EPA campus at RTP, contact Jack Morgan, Administrative Assistant, Facility Development Staff, EPA New Campus Project, phone 919-541-1869.

(7) The *South Coast Air Quality Management District Rule #1168 Adhesive Applications* can be obtained through the following website: www.aqmd.gov/rules.html/r1168.html.

(8) The *Bay Area Air Resources Board Regulation 8, Rule 51-Adhesive and Sealant Products* can be obtained through the following website: www.baaqmd.gov/regs/rg0851.pdf.

(9) *Green Seal Paints and Coatings Requirements: Paints (GS-11)*, First Edition (May 20, 1993) can be obtained through the following website: www.greenseal.org/standard/paints.htm.

(10) The *Carpet and Rug Institute Green Label Indoor Air Quality Test Program* can be obtained through the following website: www.carpet-rug.org.

(11) *ASHRAE Standard 55-1992, Addenda 1995 Thermal Environmental Conditions for Human Occupancy, Including ANSI/ASHRAE Addendum 55a-1995* can be obtained through the following website: www.ashrae.org

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(12) An *Indoor Air Quality Tools for Schools* kit has been developed by the US EPA in cooperation with the National Education Association, the National PTA, the Council for American Private Education, the Association for School Business Officials, the American Federation of Teachers, and the American Lung Association. To order or download the kit, see the following website: www.epa.gov/iaq/schools/tools4s2.html.

(13) The US EPA has an indoor air quality website at www.epa.gov/iaq.

(14) *Building Air Quality: A Guide for Building Owners and Facility Managers* is one of the excellent publications downloadable through the US EPA's indoor air quality website. It can be ordered at www.epa.gov/iaq/base/baqtoc.html.

(15) Case studies of the use of non-toxic janitorial supplies can be found in *Cleaning National Parks: Using Environmentally Preferable Janitorial Products at Yellowstone and Grand Teton National Parks* (US EPA, 2000). It can be downloaded from www.epa.gov/oppt/library/cleaning.pdf.

(16) For information on noise levels from buildings, see the excerpt from the *Orange County (NC) Economic Development Districts Design Manual* in Section V of this Appendix.

III. Glossary

Acceptable Indoor Air Quality: Air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction. (Definition from ASHRAE Standard 62-1999.)

Air Cleaning: The process that uses filters and other devices to reduce the concentration of airborne contaminants, such as microorganisms, dusts, fumes, respirable particles, other particulate matter, gases, and/or vapors in air.

Albedo: The ratio of reflected light to the total amount falling on a surface. A high albedo indicates high reflectance properties.

Ambient Temperature: The surrounding temperature about a particular area.

Biodiversity: The tendency in ecosystems, when undisturbed, to have a large number and wide range of species of animals, plants, fungi, and microorganisms. Human population pressure and resource consumption tend to reduce biodiversity.

Bioswales: Strategically placed earthen depressions that capture stormwater and filter it using native wetland plants.

Brownfields: Abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination.

Building Commissioning: A systematic process beginning in the design phase, lasting at least one year after construction, and including the preparation of operating staff on ensuring, through documented verification, that all building systems perform interactively according to the documented design intent and the owner's operational needs.

Btu (British Thermal Unit): A measure of energy quantity that is required to raise the temperature of one pound of water one degree Fahrenheit in one hour.

Building Envelope: Those building elements that enclose the conditioned spaces and which are designed to resist the transfer of energy to and from the conditioned spaces to the exterior.

Building Orientation: The on-site placement that permits a facility to take advantage of the

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available climate characteristics (winds, solar energy, sunlight, etc.) to use passive design methods, when possible, to provide for human comfort.

Constructed Wetlands: A low technology method to purify water using the biological processes that are found in modified or newly created wetlands.

Chlorofluorocarbons (CFCs): A family of chemicals used in refrigeration, air conditioning, packaging, insulation, or as solvents and aerosol propellants. Because CFCs are not destroyed in the lower atmosphere they drift into the upper atmosphere where their chlorine components destroy the earth's protective ozone layer.

Clerestory: Clerestories have many of the attributes of skylights except that they occur in the vertical rather than the horizontal plane.

Composting: The process whereby organic wastes, including food wastes, paper, and yard wastes, decompose naturally, resulting in a product rich in minerals and ideal for gardening and farming as a soil conditioner, mulch, resurfacing material, or landfill cover.

Composting Toilet: A technology that treats human waste by composting and dehydration to produce a useable end product that is a valuable soil additive. This technology uses little or no water, unlike systems linked to sewers or to on-site septic systems.

Crime Prevention Through Environmental Design (CPTED): A design strategy that works to create a safe and secure built environment by employing design methods to establish natural surveillance, natural access control, and natural territorial control of a site and a facility.

Cultural Landmark: A structure, object, and/or site that is perceived by the local or regional community to symbolize, identify, celebrate, or memorialize significant aspects of the community's social, political, or economic, history, character, goals, or aspirations.

Daylighting: The illuminating of building interiors using beam sunlight and/or diffuse light from the sky through glazing in the walls and/or roof of a building envelope.

Deconstruction: A process of renovation or demolition whereby existing material resources (wood, door frames, etc.) are removed during renovation or demolition in such a way that they can be reused again in the same or another project.

Edible Landscaping: Edible individual plants (fruit trees, herbs, flowers) or farmed plants (vegetables) that are located to provide ground cover, visual appeal, and food.

Fossil Fuel: A fuel, such as coal, oil, and natural gas, produced by the decomposition of ancient (fossilized) plants and animals.

Fuel cell: A technology that uses an electrochemical process that depends on a hydrogen and oxygen source to transfer energy, resulting in the generation of electrical current, heat, and water. The hydrogen source is some form of hydrogen (pure or in the form of a fossil fuel), while ambient air is used for the oxygen source. Although fossil fuels can be used to operate fuel cells, there is significantly less pollution produced when compared to fossil fuel combustion. The heat and water generated can be used for other facility operations.

Geothermal Heat Exchange Technology: This technology uses the relatively constant temperature of soil or subsurface water as a heat source and sink for a heat pump. In winter, geothermal heat exchange technology uses heat from subsurface water to heat buildings; in summer, this technology extracts heat from the building into subsurface water for cooling.

Gray Water: Wastewater that does not contain fecal contamination and originates from sinks, showers, and other related water sources. Gray water can be reused for irrigation after simple filtration.

Greenfield: A land area that is essentially in its natural state with no constructions or other improvements that would have disrupted the original ecosystem.

Green Roofs: A passive low technology method that reduces roof stormwater runoff and heat uptake by installing a layer of diverse drought and sun tolerant plants in a matrix of soil and supporting assemblies on the roof.

Heat Island Effect: The additional heating of the air over a city or other surface area as the result of the replacement of vegetated surfaces with those composed of asphalt, concrete, rooftops, and other man-made materials.

Heat Pump: A mechanical means to condition air by transferring heat energy, either by extracting it from low temperature air or discarding it from high temperature air to, respectively, heat or cool a space.

Heat Recovery Systems: Building mechanical systems that capture waste heat from another system and use it to replace heat that would otherwise come from a primary energy source.

Hydrochlorofluorocarbons (HCFCs): HCFCs are generally less detrimental to the depletion of stratospheric ozone than related chlorofluorocarbons. HCFCs are generally used to replace CFCs where mandates require CFCs to be eliminated. A total ban on all CFCs and HCFCs is scheduled effective 2030.

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Indoor Air Quality (IAQ): The characteristics of interior air with regard to its temperature, humidity, and contaminants (dust, particulate matter, gases, pollen, dust mites, allergens, fumes, etc.) that impact human health, safety, and comfort.

Indoor Environment Quality (IEQ): The characteristics of the interior environment with regard to the impact of air quality, lighting, acoustics, and wayfinding on human health, safety, and comfort.

Integrated Design: A comprehensive design approach that considers the interrelated and synergistic nature of a project's components and systems in order to optimize energy and environmental performance.

Integrated Pest Management: A coordinated approach to pest control that is intended to prevent unacceptable levels of pests by the most cost-effective means with the least possible hazard to building occupants, workers, and the environment.

Life-Cycle: All stages of a product's life that extends from acquisition of raw materials through processing, manufacturing, fabrication, use, renovation, reuse, and recycling.

Life Cycle Cost: The amortized annual cost of a product, including all capital costs, installation costs, operating costs, maintenance costs, and disposal costs discounted over the lifetime of a product.

Life Cycle Assessment: The comprehensive examination of a product's environmental and economic aspects and potential impacts throughout its lifetime, including raw material extraction, transportation, manufacturing, use and disposal.

Light Pollution: Excess brightness in the sky resulting from direct and indirect lighting above urban areas. Light pollution has had a negative impact on the urban ecology, disrupting biological cycles in the plants and animals.

Light Shelf: A horizontally-placed light reflector.

Living Machine: A technology used to purify waste water (gray water or raw sewage) by the use of biological processes that absorb the nutrients, break down the toxins, and filter particulate matter using the biological action of mainly bacteria and plant roots.

Low-e Windows: "Low-e" (low emissivity) windows reflect heat, not light, and therefore keep spaces warmer in the winter and cooler in the summer.

Natural Capital: The resource services (filtration, storage, distribution, conversion, assimilation) that are provided by the non-renewable biological and geological processes (i.e., forests and

oceans).

Natural Income: The renewable resources (trees, biomass, fish) that are produced by non-renewable biological and geological processes.

Non-renewable Resource: A resource that cannot be replaced in the environment as fast as it is being consumed. Fossil fuels (e.g., coal, petroleum, natural gas) are examples of nonrenewable energy sources.

Optimization: Maximizing the performance of a facility system (lighting, HVAC, etc.) while using the least amount of materials possible. (See Integrated Design.)

Ozone: 1. *Stratospheric ozone:* In the stratosphere (the atmosphere layer beginning 7 to 10 miles above the earth), ozone is a form of oxygen found naturally which provides a protective layer shielding the earth from ultraviolet radiation's harmful effects on humans and the environment. 2. *Ground level ozone:* Ozone produced near the earth's surface through complex chemical reactions of nitrogen oxides, volatile organic compounds, and sunlight. Ground level ozone is the primary component of smog and is harmful to humans and the environment.

Particulate Matter: A state of matter in which solid or liquid substances exist in the form of aggregated molecules or particles. Airborne particulate matter is typically in the size range of 0.01 to 100 micrometers. Respirable particles are those, less than 10 micrometers in aerodynamic diameter, that penetrate into and are deposited in the nonciliated portion of the lung.

Photovoltaic Panels (PVs): Photovoltaic devices use semiconductor material to directly convert sunlight to electricity. Power is produced when sunlight strikes the semiconductor material and creates an electric current.

R-value: A measure of the thermal resistance of material.

Recycling: The activities of collection, separation, and processing by which waste or surplus materials are used in the manufacture of new products other than fuel for producing heat or power by combustion.

Regenerative Design: A design strategy where a facility is designed and constructed so that it is able to replace some or all of the resources it uses through its own functional operations. The facility becomes a net producer of energy, water, material, and nutrient resources.

Renewable Energy: Energy resources such as wind power or solar energy that can keep producing indefinitely without being depleted.

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Sustainability: A principle that holds that economic growth can be managed so that natural resources can be used in such a way that the resource needs of current and future generations are assured

Sustainable Design or Development: An approach to planning, design, and construction that embraces the concept of sustainability.

Task Lighting: Lighting that is occupant controlled and provides task appropriate lighting located at the site of the task activity.

Thermal Bridge: A highly conductive element such as a metal channel in the building envelope that penetrates or bypasses the less conductive element such as insulation, and acts as a thermal short circuit through the insulation system.

Thermal Buffer: A space or other element that reduces the heating and cooling load on another space located between the space and the exterior.

Universal Design: A design strategy in which the built environment is designed and constructed so that it provides healthy and safe services for all age groups and abilities without frequent facility renovation or modification.

U-Value: The rate of heat flow in Btu/hr/sf/degrees through a construction assembly between the inside and outside ambient air.

Variable Air Volume (VAV): Use of varying air flow to control the condition of air, in contrast to the use of constant flow (often) with varying temperature.

Volatile Organic Compounds (VOCs): Chemicals that contain carbon molecules and are volatile enough to evaporate from material surfaces into indoor air at normal room temperatures (referred to as off-gassing). Examples of building materials that may contain VOCs include, but are not limited to, solvents, paints, adhesives, carpeting, and particleboard. Signs and symptoms of VOC exposure may include eye and upper respiratory irritation, nasal congestion, headache, and dizziness.

Ventilation: The process of supplying or removing air by natural means (including infiltration) or mechanical means to or from a space for the purpose of controlling air contaminant levels, humidity, or temperature within the space. Mechanical ventilation is provided by mechanically powered equipment such as motor-driven fans and blowers but not by devices such as wind-

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driven turbine ventilators and mechanically operated windows. Natural ventilation is provided by thermal, wind, or diffusion effects through doors, windows, or other openings in the building.

Waste: The output of an activity or process that is not being used and is released into the environment.

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IV. Comparison Between High Performance Guidelines and *LEED™* Version 2.0

Heading from High Performance Guidelines: Triangle Region Public Facilities (Triangle HPG)		Possible Credits	<i>LEED™</i> Credits	Comments:
1.0	Quality Management	1	None	Not included in <i>LEED™</i> 2.0
1.1	Basic Quality Management	Required	None	Not included in <i>LEED™</i> 2.0
1.2	Comprehensive Building Commissioning	1	Required	Triangle HPG revises <i>LEED™</i> 2.0 Building System Commissioning
2.0	Site	19	14	
2.1	Erosion and Sedimentation Control	Required	Required	Triangle HPG does not reference EPA document, only references state and local standards and codes; references NC DENR standard in technologies and strategies; adds two deliverables.
2.2	Site Selection	1	1	Triangle HPG expands intent as well as technologies and strategies to include local development plans; adds two requirement criteria and one deliverable.
2.3	Redevelopment			
2.3.1	Increase density on site	1	1	Triangle HPG removes the word “urban” and the density figure of 60,000 sq.ft. per acre; adds one deliverable.
2.3.2	Increase density within existing infrastructure	1	None	Not included in <i>LEED™</i> 2.0
2.4	Brownfield Redevelopment	1	1	Triangle HPG adds issue of “perceived hazard” in technologies and strategies; adds one deliverable.
2.5	Alternative Transportation			
2.5.1	Alternative Transportation-Project location	1	1	Triangle HPG expands requirement and deliverable to include trails, greenways, and bikeways.
2.5.2	Alternative Transportation-Bicycle facilities	1	1	
2.5.3	Alternative Transportation-Alternate fuel vehicle parking	1	1	Triangle HPG stipulates preferred parking for alternative fuel vehicles, not installation of refueling stations, in requirement and deliverable.
2.5.4	Alternative Transportation- Preferred parking spaces	1	1	
2.5.5	Alternative Transportation-Pedestrian and bike access	1	None	Not included in <i>LEED™</i> 2.0
2.6	Site Disturbance			
2.6.1	Site Disturbance-Cultural landmarks	1	None	Not included in <i>LEED™</i> 2.0
2.6.2	Site Disturbance-Greenfield sites	1	1	Triangle HPG modifies requirement; adds one deliverable.
2.6.3	Site Disturbance-Reduce footprint 30%	1	1	Triangle HPG modifies requirement and deliverable.
2.6.4	Site Disturbance-Reduce footprint 40%	1	None	Not included in <i>LEED™</i> 2.0
2.7	Stormwater Management			
2.7.1	Stormwater Management- Runoff	1	1	Triangle HPG expands requirement; adds max. and min. parking requirements to technologies and strategies.

2.7.2	Stormwater Management-Treatment systems	1	1	Triangle HPG stipulates NC DENR Water Quality Division Best Management Practices in requirement and deliverables.
2.8	Heat Islands			
2.8.1	Heat Islands-General measures	1	1	Triangle HPG adds one deliverable.
2.8.2	Heat Islands-Roofing systems	1	1	
2.9	Light Pollution	1	1	Triangle HPG expands intent and modifies requirement; adds one deliverable.
2.10	Post-commissioning Monitoring	1	None	Not included in <i>LEED</i> ™ 2.0
3.0	Water	9	5	
3.1	Water Efficient Landscaping			
3.1.1	Water Efficient Landscaping-50% reduction in water use	1	1	Triangle HPG includes ground-water in requirements; adds two deliverables.
3.1.2	Water Efficient Landscaping-100% reduction in water use	1	1	Triangle HPG includes ground-water and drought tolerant plants in requirements; adds two deliverables.
3.2	Innovative Wastewater Technologies	1	1	
3.3	Water Use Reduction			Triangle HPG expands intent.
3.3.1	Water Use Reduction-Reduce aggregate by 20%	1	1	Triangle HPG adds one deliverable.
3.3.2	Water Use Reduction- Reduce aggregate by 30%	1	1	Triangle HPG adds one deliverable.
3.3.3	Water Use Reduction-50% potable water from rain	1	None	Not included in <i>LEED</i> ™ 2.0
3.3.4	Water Use Reduction-75% potable water from rain	1	None	Not included in <i>LEED</i> ™ 2.0
3.3.5	Water Use Reduction-100% potable water from rain	1	None	Not included in <i>LEED</i> ™ 2.0
3.4	Post-commissioning Monitoring	1	None	Not included in <i>LEED</i> ™ 2.0
4.0	Energy and Atmosphere	22	17	Triangle HPG revises Building System Commissioning from <i>LEED</i> ™ and includes in Quality Management section.
4.1	Minimum Energy Performance	Required	Required	Triangle HPG expands and modifies requirement as well as technologies and strategies to include state and local codes and requirements; adds one deliverable.
4.2	CFC Reduction in HVAC&R	Required	Required	Triangle HPG adds one requirement and expands technologies and strategies to include all materials and systems be CFC-free.
4.3	Optimal Energy Performance-New/Existing Buildings			Triangle HPG measures energy consumption in BTUs/Hour/SF; changes points allocated; expands technologies and strategies; adds numerous deliverables in project phases of pre-design, design development, and construction documents.
4.3.1	Optimal Energy Performance-20%/10%	1	2	Triangle HPG decreases credit by one.
4.3.2	Optimal Energy Performance-30%/20%	3	3	
4.3.3	Optimal Energy Performance-40%/30%	2	2	
4.3.4	Optimal Energy Performance-50%/40%	2	2	
4.3.5	Optimal Energy Performance-60%/50%	2	2	

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4.4	Renewable Energy			Triangle HPG increases points for all levels 5%, 10%, and 20%; stipulates energy consumption, not energy cost; adds one deliverable.
4.4.1	Renewable Energy-5% renewable fuels	2	1	
4.4.2	Renewable Energy-10% renewable fuels	2	1	
4.4.3	Renewable Energy-20% renewable fuels	2	1	
4.5	Elimination of HCFCs and Halons	1	1	Triangle HPG expands and modifies requirement to include CFC phaseout for existing building reuse.
	<i>LEED Additional Commissioning</i>	None	1	See Quality Management heading in Triangle HPG.
4.6	Measurement and Verification			Triangle HPG adds two new requirements; adds “quality management report” to technologies and strategies; adds deliverables.
4.6.1	Measurement and Verification-Staff training	1	None	Triangle HPG partially replaces <i>LEED</i> TM 2.0 prerequisite for commissioning and requires staff training to ensure system operates as designed.
4.6.2	Measurement and Verification-Energy management plan	1	None	Triangle HPG requires energy management plan with annual verification and documentation of systems performance.
4.6.3	Measurement and Verification-Follow IVMVP process	1	1	
4.7	Green Power			Triangle HPG adds two requirements and deliverables.
4.7.1	Green Power-25% by grid	1	None	
4.7.2	Green Power-Purchase renewable power or generate renewable power on site	1	1	Triangle HPG allows for <i>LEED</i> TM 2.0 point OR for a point by on-site generation with net-metering.
5.0	Materials and Resources	20	13	
5.1	Storage and Collection of Recyclables	Required	Required	Triangle HPG modifies requirement---addresses types of marketable recyclable waste that might be generated by building occupants; expands technologies and strategies.
5.2	Building Reuse			Triangle HPG revises requirements to exclude roof assemblies and interior ceiling systems.
5.2.1	Building Reuse-75% of building structure and shell	1	1	Triangle HPG excludes roof assemblies.
5.2.2	Building Reuse-100% of building structure and shell	1	1	Triangle HPG excludes roof assemblies.
5.2.3	Building Reuse-100% of building structure and shell and 50% of interior walls and flooring	1	1	Triangle HPG excludes ceiling systems.
5.3	Construction Waste Management			Triangle HPG expands the intent and adds three requirements; adds technologies and strategies as well as deliverables.
5.3.1	Construction Waste Management-Develop checklist	1	None	Not included in <i>LEED</i> TM 2.0

5.3.2	Construction Waste Management-Develop management plan	1	None	Not included in <i>LEED</i> ™ 2.0
5.3.3	Construction Waste Management-Recycle/salvage 75% of grading and land clearing debris	1	None	Not included in <i>LEED</i> ™ 2.0
5.3.4	Construction Waste Management- Recycle/salvage 50% of construction and demolition debris	1	1	
5.3.5	Construction Waste Management- Recycle/salvage 75% of construction and demolition debris	1	1	
5.4	Resource Reuse			Triangle HPG modifies intent; adds one requirement and changes % of other two; adds deliverables.
5.4.1	Resource Reuse-2% of building material salvaged or refurbished	1	1	Triangle HPG reduces % from <i>LEED</i> ™ 2.0; excludes furniture, fixtures, and equipment.
5.4.2	Resource Reuse-5% of building material salvaged or refurbished	1	1	Triangle HPG reduces % from <i>LEED</i> ™ 2.0; excludes furniture, fixtures, and equipment.
5.4.3	Resource Reuse-10% of furniture, fixtures, equipment	1	None	Not included in <i>LEED</i> ™ 2.0
5.5	Recycled Content			Triangle HPG expands intent, requirements, and technologies and strategies to include “site development”; modifies deliverables.
5.5.1	Recycled Content-25% of facility material contains 20% post-consumer material	1	1	Triangle HPG includes site development.
5.5.2	Recycled Content-50% of facility material contains 20% post-consumer material	1	1	Triangle HPG includes site development.
5.6	Local/Regional Materials			Triangle HPG expands intent, requirement, and technologies and strategies to include “site development.”
5.6.1	Local/Regional Materials-20% materials manufactured in 500 mile radius	1	1	Triangle HPG includes site development.
5.6.2	Local/Regional Materials-50% of above materials are harvested within 500 mile radius	1	1	Triangle HPG changes manufacturing requirement to harvesting.
5.7	Rapidly Renewable Materials	1	1	Triangle HPG reduces % from <i>LEED</i> ™ 2.0.
5.8	Certified Wood			Triangle HPG expands the intent and adds a requirement for 10% certified wood use.
5.8.1	Certified Wood-Minimum of 10% wood certified	1	None	Not included in <i>LEED</i> ™ 2.0
5.8.2	Certified Wood-Minimum of 50% wood certified	1	1	
5.9	Durable Materials			
5.9.1	Durable Materials-Do life cycle analysis for two building systems	1	None	Not included in <i>LEED</i> ™ 2.0
5.9.2	Durable Materials-Do life cycle analysis for two additional building systems	1	None	Not included in <i>LEED</i> ™ 2.0
6.0	Indoor Environment	25	15	
6.1	Minimum Indoor Air Quality Performance	Required	Required	Triangle HPG adds requirement for CO monitoring system; expands technologies and strategies to include a “basic quality management plan and report.”

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6.2	Environmental Tobacco Smoke Control	Required	Required	Triangle HPG expands requirement to include a “basic quality management plan”; adds one deliverable.
6.3	Carbon Dioxide Monitoring			Triangle HPG expands intent; adds a new requirement and modifies one; expands technologies and strategies to include a “basic quality management plan and report”; adds three deliverables.
6.3.1	Carbon Dioxide Monitoring - Install monitoring system	1	1	Triangle HPG adds an option: 1000 ppm for indoor air at any time.
6.3.2	Carbon Dioxide Monitoring - Tie system into DDC system	1	None	Not included in <i>LEED</i> ™ 2.0
6.4	Ventilation Effectiveness			Triangle HPG expands a requirement and adds a requirement; expands technologies and strategies to address carbon dioxide monitoring; Adds deliverables.
6.4.1	Ventilation Effectiveness-Air change effectiveness minimum	1	1	Triangle HPG adds requirements of EPA, NIOSH, or OSHA, whichever is most stringent.
6.4.2	Ventilation Effectiveness-Loading dock and mechanical room ventilation	1	None	Not included in <i>LEED</i> ™ 2.0
6.5	Construction IAQ Management Plan			Triangle HPG modifies requirements and expands the technologies and strategies.
6.5.1	Construction IAQ Management Plan-Minimum ventilation of facility during construction	1	1	
6.5.2	Construction IAQ Management Plan-Building flushing	1	1	Triangle HPG modifies flush out procedure.
6.6	Low-emitting Materials			Triangle HPG expands technologies and strategies; adds one deliverable to all four points.
6.6.1	Low-emitting Materials-Adhesives	1	1	
6.6.2	Low-emitting Materials-Paints and Coatings	1	1	
6.6.3	Low-emitting Materials-Carpet systems	1	1	
6.6.4	Low-emitting Materials-Composite materials	1	1	
6.7	Indoor Chemical and Pollutant Source Control			Triangle HPG expands intent; adds one requirement; expands technologies and strategies; adds two deliverables.
6.7.1	Indoor Source Control-Minimize cross-contamination	1	1	
6.7.2	Indoor Source Control-Use good housekeeping protocols.	1	None	Triangle HPG addresses post construction housekeeping procedures and products.
6.8	Controllability of Systems			Triangle HPG adds one deliverable.
6.8.1	Controllability of Systems-Min. number of operable windows	1	1	
6.8.2	Controllability of Systems-Provide individual controls	1	1	
6.9	Thermal Comfort			Triangle HPG expands technologies and strategies to include “basic quality management plan and report”; adds two deliverables.

Appendix

V. Copies of Documents

(A) Noise Provisions From *Orange County (NC) Economic Development Districts Design Manual* (as amended through August 20, 1996)

SOUND LEVELS AND HUMAN RESPONSE		
Common Sounds	Sound Levels dB(A)	Effect
Motorcycle revving up Pile drivers (32 feet) Chain saw (2 feet)	110	
Jet flyover (1000 feet)	100	
Garbage truck (50 feet) Power lawn mower (3 feet) Metal working shop	90	Very annoying
Heavy truck (50 feet)	80	Annoying
Noisy urban area (daytime) Shouting (3 feet)	70	Telephone use difficult
Power lawn mower (100 feet)	60	Intrusive
Conversation (3 feet) Commercial Area Heavy Traffic (300 feet) Large Business Office	50	Quiet
Light auto traffic (100 feet) Suburban residential (daytime) Rural residential (daytime)	40	
Quiet Urban Nighttime	30	Very quiet
Quiet Suburban Nighttime Library Soft whisper (15 feet)	20	
Quiet Rural Nighttime	10	Just audible
Broadcasting studio	0	Hearing begins

Noise

In all circumstances, any unwanted, unpleasant or loud sound is referred to as **noise**. Although a person's acceptance of the type and level of noise is highly subjective, noise often disturbs people by interfering with communication, sleep, and other everyday activities. Noise can also cause physical discomfort and, if intense enough, can cause hearing damage.

Shown on the accompanying table are typical sound levels of everyday occurrences and how they compare in potential harm to hearing. Sound levels are generally measured through the use of a logarithmic scale called the **decibel (dB) scale**. 70 dB is the point at which noise begins to harm hearing, 60 dB is the threshold of stress response, and 45 dB disturbs sleep. To the ear, each 10 dB increase seems twice as loud.

As noted previously in this Design Manual, the purpose of Economic Development Districts is to allow a mixture of land uses, ranging from residential to office, service, retail, distribution, and light industrial uses. Since these uses have the potential for generating noise from a wide variety of sources, the general rule is that no permitted, special or accessory use in an Economic Development District shall generate noise that tends to have an annoying or disruptive effect upon uses located within and outside the boundaries of the District. The table shown on the following page establishes the maximum permissible noise levels for uses in the Economic Development District.

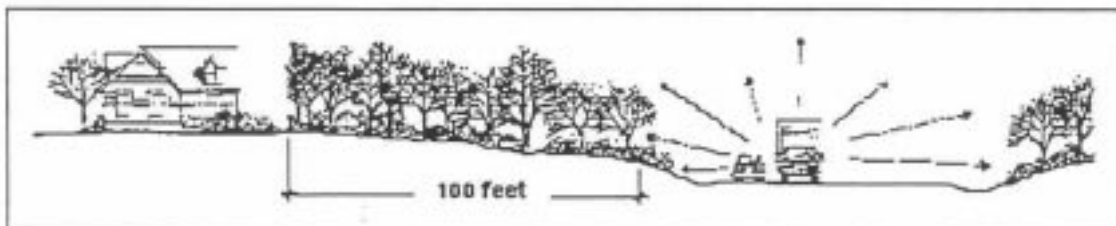
When required to verify compliance with the standards, sound levels will be measured with a sound-level meter with an A-weighted filter, manufactured according to standards prescribed by the American National Standards Institute, which automatically takes account of the varying effect on the human ear of different pitches. Sound level measurements will be expressed in dB(A) to reflect

the use of an A-weighted filter and will be taken at the boundaries of the lot on which the activity is conducted.

MAXIMUM PERMITTED SOUND LEVELS		
Receiving Land Use Category	Noise Level Limits [dB(A)] for Generating Land Use Category	
	7:00 p.m. to 7:00 a.m.	7:00 a.m. to 7:00 p.m.
Residential development of all types	45	50
Commercial, including office, service, and retail establishments	55	50
Light industrial, including distribution and warehousing facilities	65	60

Footnotes:
 1/ Impact noises or sounds that occur intermittently rather than continuously are permissible up to a level of 10 dB(A) in excess of the figures listed in the table provided the source from which they are generated does not operate more than one minute in any one hour. This exception shall not apply from 7:00 p.m. to 7:00 a.m. when the adjacent lot is used or zoned for residential purposes.
 2/ Noise levels resulting from construction or other temporary activities which occur between the hours of 7:00 a.m. and 7:00 p.m. are exempt from the standards listed in the table.

Where proposed land development does not meet the maximum permitted noise levels because of the nature of or equipment used in the operation, design features included as part of the comprehensive site development plan may be utilized to insure that noise levels fall within the range permitted by these performance standards. One method of reducing noise levels is through the provision of a 100-foot landscaped buffer at the boundary of the Economic Development District (see Landscape Design Criteria). Such buffers, when densely vegetated, have resulted in 3-5 decibel reductions in noise levels.

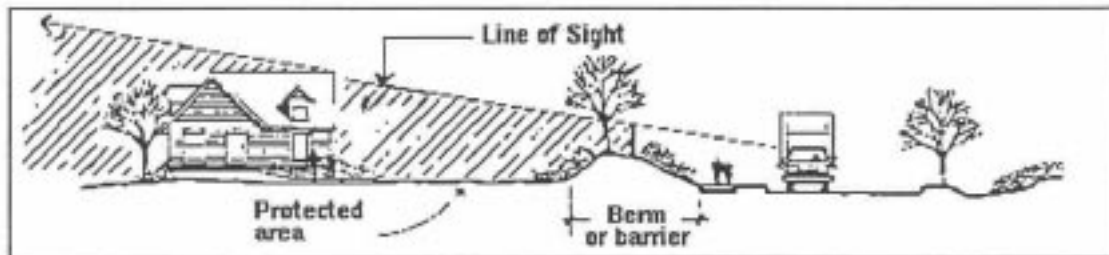


A densely vegetated buffer of 100 feet adjacent to a highway or land use results in a 3-5 decibel reduction in noise levels.

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Another means of mitigating noise levels is through the use of existing topographic conditions or modifying the topography to provide barriers to noise. For example, a residential area in a valley or downwind of an industrial plant is more susceptible to noise. Locating the plant downhill from a residential area or constructing landscaped berms or berms in combination with walls is another effective method of reducing noise levels.



Landscaped berms or berms in combination with walls can serve as effective methods of reducing noise levels.

Where berms or similar barriers are used, they must be erected as close to the noise source as possible to maximize the diffraction angle. In addition, the length of a barrier must be at least one to two times the distance between the barrier of the area to be protected with no holes or gaps present. The height of the barrier must be such that the line of sight between the noise source and the area to be protected is interrupted.

A final method of mitigating excessive noise levels is through locating noise-producing equipment and/or activities within a building. As an example, Federal Express has provided both interior and exterior loading areas at its facility in Durham. Parcels are off-loaded at exterior loading docks then moved to local delivery trucks on the interior of the building. Noise control for the exterior loading area is provided through the use of berms with landscaping. Noise control for the interior loading areas is provided by the building.

Regardless of the design features used, they must be clearly identified on the comprehensive site development plan and documentation provided concerning the source and level of noise, and the specific manner in which the design feature(s) will reduce the noise to acceptable levels.