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From Brownfields to Green Homes

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Brownfields – defined by the Environmental Protection Agency as abandoned or underutilized properties where reuse is complicated by pollution – are becoming an increasingly important national issue. The EPA estimates that there are 450,000 brownfield sites nationwide, while the National Brownfield Association puts the number closer to one million. Either way, there are millions of acres of brownfields in the United States, leaving a tremendous amount of underutilized space and scarred land sitting fallow.

Many would agree that the clean up and reuse of these properties is a good thing for our country. It helps rid communities of pollution, creates regional economic engines and minimizes suburban sprawl.

A question being increasingly asked is: What happens to those properties once they are cleaned?

Cherokee Investment Partners believes the answer to that question should be green, sustainable development.

Cherokee is the world's largest firm specializing in brownfield redevelopment. To date, the company has remediated 4,680 acres in North America and Europe. The development taking place on this remediated acreage is expected to yield 28,600 homes, 3.8 million square feet of retail space, one million square feet of office space and nearly three million square feet of industrial space.

As the nation's leading investor in brownfield reclamation, Cherokee is in a unique position to influence the design and construction of

thousands of buildings on our sites. "Given our core environmental ethic, how could we not become more aggressive about influencing the greening of the vertical development of our sites?" said Jonathan Philips, Senior Director of Cherokee.

Hopefully, this model of sustainability will influence development beyond our projects.

While Cherokee has traditionally focused its work on the horizontal development of its sites – remediation, ground improvements, infrastructure and master plan design – Cherokee's increasing focus on sustainable redevelopment has included greater attention to the "greenness" of the buildings that will ultimately occupy these sites.

For instance, influencing the vertical construction on our sites is now integral to our overall vision. Cherokee is now looking beyond site remediation to whole site development to create thoughtfully designed, progressive, low-impact communities.

As Steve Johnson, Administrator of the US EPA, has said, "We have a responsibility to sustain – if not enhance – our natural environment and our nation's economy for future generations."

Inefficient, conventional buildings are a heavy burden on our environment and health. In the United States, the built environment accounts for an estimated 35 percent of all energy, water and materials consumption. Buildings generate similar proportions of air and water pollution, returning contaminated water to our ecosystems and compounding human and environmental health issues. Meanwhile, 30 percent of new and renovated buildings have bad indoor air quality – sickening workers and reducing productivity.

These impacts are unsettling, but also represent a great opportunity.

This year Cherokee developed a comprehensive set of guidelines to help implement its vision and provide a consistent framework

to direct remediation and bring sustainable land planning, design and green building principles to our projects. These guidelines, which draw heavily from work by leading organizations such as the USGBC, the NAHB Model Green Building Guidelines, Advanced Energy, the Rocky Mountain Institute, the Earthcraft Guidelines and William McDonough + Partners, emphasize social equity, stakeholder input, livability and local economics in addition to addressing environmental concerns.

The Mainstream Greenhome: A Cherokee Living Laboratory

For stakeholders and the public at large, Cherokee began working on a green building demonstration project this year, called the National Homebuilder Mainstream GreenHome™. The house will look and function like a typical home, but will have superior indoor air quality, and be much more energy- and water-efficient than its neighboring homes.

As a result, the goals of the GreenHome™ include:

- Using 50% less fossil fuel than the conventional home
- Recycling or reusing 90% of all organic waste on site
- Consuming 50% less water than the conventional home
- Recycling 75% of all construction and demolition waste
- Retaining 95% of all storm water on site for reuse

The home is sited on a lot with suboptimal natural green building attributes that provides very poor solar orientation; in fact, the home is oriented 40° off true south. Some homebuilders believe that proper solar orientation is necessary for building truly green. Cherokee's thought is that even though not every lot will afford the perfect orientation, builders can still work within their constraints to build green. Cherokee has stepped up to a real world challenge by devising a building envelope strategy that includes energy efficient windows as well as greater use and attentive placement of insulation.

Despite issues that some would consider roadblocks to accomplishing our goals, the GreenHome will utilize a range of strategies, products, and technological innovations to minimize impact on the environment without sacrificing comfort, including:

Sustainable Site

- Landscaping – A landscaping design technique known as xeriscaping utilizes native and/or drought resistant species to minimize irrigation needs. Designed by the North Carolina Botanical Garden, the landscaping scheme considers wildlife habitat and food sources so as to create a yard certified with the National Wildlife Federation Backyard Habitat Program. Strategic tree selection and placement minimize energy use by mitigating the effects of sunlight and wind on the home. www.ncbg.unc.edu
- Stormwater Management – The landscaping uses swales along the sidewalks and driveway to allow groundwater infiltration of stormwater runoff and funnel it to BRAE underground storage tanks where the water gradually percolates into the ground. This technique filters contaminants naturally onsite while greatly minimizing runoff to the city stormwater system. The goal is for post-construction hydrology to mimic pre-construction

conditions as closely as possible and minimize the undesirable effects of stormwater runoff. www.braewater.com

- Termite Control – Several non-toxic termite strategies minimize the need for chemical sprays both inside and outside the home. A metal plate is installed along the exterior of the house between the foundation and framing. Non-toxic borates are applied to the bottom three feet of framing along the edge of the house and kill any termites entering the home.
- Pest Management – The home uses integrated pest management to minimize the need for harmful chemical application on site. Natural mosquito pest control techniques, including the facilitation of onsite habitat for natural mosquito predators, reduce the need for chemical repellents and enrich site biodiversity.
- Reduced Building Footprint – Designers utilized the topographical characteristics of site to achieve a reduced building footprint by integrating the garage below the home.

Energy Efficiency

- Spray Foam Insulation – Dow closed cell spray insulation is applied throughout the home's exterior walls and attic. Upon application, the foam immediately expands to four times its original size to harden and tightly seal all corners of the home, conserve energy, and conditioned indoor air and not off-gas for the home's occupants. www.dow.com
- Rigid Foam Insulation – Dow's rigid foam insulation, 1/2" thick with an R value of 2, is applied over the exterior wall OSB sheathing to reconcile the daylighting benefits of heavy glazing by uniformly covering the framing and providing greater insulation to the home. This provides much better insulation than wood. www.dow.com
- Energy Efficient Roofing – ElkCorp's low petroleum, highly reflective shingles utilize cool-roof technology to reflect sunlight, minimize heat gain, and effectively reduce the energy needed to cool the home. The shingles' durability provides the ability to execute the GreenHome's energy-efficient sealed attic strategy without reducing the lifetime of the roof. www.elkcorp.com
- Sealed attic and crawlspace – The attic and crawlspace are sealed and unvented, yet insulated and semi-conditioned, to improve energy performance while bettering the overall air quality of the home.
- Foundation – The home's foundation is insulated on the exterior with a 2" rigid foam board that provides an R-value of 10. The basement slab is also insulated with a 1" rigid foam with an R-value of 5. These techniques used by The Waterproofing Co. add greater insulation to and improve the comfort of the basement.
- Daylighting – Abundant glazing and careful window design including combinations of low-e, high performance sun and tempered Andersen Window glass encourage natural daylight throughout the home and reduces the need for artificial light. These windows exceed ENERGY STAR standards by 15% to effectively minimize heat loss and gain. They also are manufactured with FSC-certified wood. The home also features three Centerpoint translucent roofs over three gable ends, allowing light to penetrate the home from above, yet maintain thermal comfort through advanced gel insulation technology. www.andersenwindows.com, www.cptsystems.com, www.fscus.org



- Window Shading – Lutron lighting control and shading solutions enhance the beauty and functionality of the home's daylighting strategy. The Sivoia QED shading system conveniently controls sunlight to reduce glare and solar heat gain to protect interior spaces. The RadioRA Home Dimming System integrates both daylight and electrical light with a one-touch control of all the light in the home. With automatic shading tracking the position of the sun and season, natural lighting is maximized when desired and less electricity is utilized to operate artificial lighting. www.lutron.com
- Thermal Massing – While certain external siding materials typically used for thermal massing are not deemed conducive to the Mainstream GreenHome concept, General Shale bricks are attractive and slowly absorb the external ambient temperature so as to moderate the night-day temperature fluctuations of the Raleigh, NC mixed climate. www.generalshale.com
- ENERGY STAR™-certified – The home will be ENERGY STAR-certified and utilize ENERGY STAR rated appliances, windows, lights and roofing. Cherokee is an official partner of the US Environmental Protection Agency's ENERGY STAR Program, www.energystar.gov as well as the federal Environmentally Responsible Redevelopment and Reuse (ER3) Initiative.
- Ground Source Heat Pump – A ground source heat pump utilizes the earth's relatively consistent year-round temperature of 56° as a heat source in the winter and a heat sink in the summer to reduce heating and cooling costs by up to 70%. Designed and prepared by the Co-Energy Group, the wells run 300 feet into the ground and circulate a solution that absorbs the earth's heat during the winter and returns it in the summer. The system connects to a Florida Heat Pump heat exchanger in the home that then ties into a traditional heating and cooling ventilation system. The system also contributes to heating hot water in the summer. www.coenergygroup.com, www.fhp-mfg.com
- ERV – An energy recovery ventilator (ERV) by SummerAire uses a heat exchanger to capture heat from air leaving the house and transfer it to incoming fresh air, maintaining a high level of indoor air quality without losing the heat already invested internally.
- Solar Thermal Hot Water – Water is heated mainly by a unique Dawn Solar thermal hot water system that operates underneath the shingles of the roof and avoids all aesthetic distractions of traditional roof applied solar thermal panels. Half-inch pex tubing runs along the roof decking on the southern and western exposures of the rooftop; an antifreeze/water solution circulates through the tubing and collects heat throughout the year. This system connects to a water tank heat exchanger in the basement. The hot water is ultimately stored in a Marathon hot water tank insulated internally with Envirofoam, a high insulating and non-ozone depleting foam product. www.dawnsolar.com
- Radiant Flooring – Warmboard radiant flooring in the kitchen and master bathrooms demonstrates the comfort, energy efficiency and indoor air quality of heating via radiant floor heating. The radiant flooring systems receive heat through a heat exchanger connected to the hot water tanks. Warmboard radiant flooring uniquely integrates the radiant tubing and an aluminum coating into the floor sheathing; as a result, far less floor elevation is needed, and floors warm up quickly and evenly. www.warmboard.com
- Hot Water Heat Exchange – In addition, a GFX heat exchange system pre-heats incoming hot water with the outgoing heat from hot water running down the drain. This system saves up to 60% of the energy used for hot showers and baths.
- Photovoltaics – Atlantis Sunslates will provide over 9kW of solar generated electricity to the home. The home still draws from traditional power sources as needed; however, when the system provides more power than the home is using, it returns the excess back to the power grid and receives \$0.18/kWh by effectively selling the excess power produced to NC Green Power. This sell-back rate is 2-3x the retail base rate of electricity in North Carolina. The relationship between the Sunslates and the Dawn Solar Thermal system are uniquely symbiotic, resulting in unprecedented performance for each system. www.atlantisenergy.org
- Renewable Energy Credits – NC Green Power provides renewable energy credits to bring the home closer to its goal of carbon neutrality in operations. This means that the energy it uses on a daily basis does not contribute carbon to the atmosphere and accordingly reduces its incremental contribution to the growing concern for anthropogenically induced global climate change. www.ncgreenpower.org
- Lighting – An Energy Star Advanced Lighting Package provided by Progress Lighting utilizes light emitting diodes (LEDs) and compact florescent lights (CFLs) to significantly reduce the amount of energy needed to light the home. These lighting sources also reduce the amount of heat emitted that would otherwise be immediately rejected during the cooling season. Lutron's RadioRA system provides pre-programmed lighting scenes for various purposes and times of day. www.progresslighting.com, www.lutron.com
- Highly insulated doors – The Formanek and Humabuilt exte-

rior doors save energy with an insulation factor nearly doubles the industry norm. Furthermore, these doors provided by Koch and Co., combine aesthetics and durability as the interior side is wood while the exterior side is steel or fiberglass. www.kochandco.com/Formenak_Door.htm

- Bio-Diesel Fuel – All onsite construction vehicles are powered by Piedmont Biofuel's biodiesel, a non-toxic, biodegradable fuel that contains no sulfur, is carbon neutral, and runs in any type of diesel engine at \$3.50/gallon. www.biofuels.coop

Water Efficiency

- Rainwater Catchment System – A BRAE rainwater catchment system collects, filters and stores rainwater for re-use, diverting filtered water from the roof to an underground storage tank. The water is available for landscape irrigation or safe non-potable uses such as toilets or laundry. www.braewater.com
- High efficiency fixtures – Kohler's water-conserving plumbing fixtures minimize the water usage of toilets, showers, and faucets, yet still provide comfortable flow. www.kohler.com
- Water Conservation – The D'MAND System uses "structured plumbing" to capture water which is typically lost from faucets while waiting for hot water to come out, and return it to the hot water tank. This system is expected to have a payback of one to three years.
- Water Efficient Appliances – The KitchenAid I-Series dishwasher integrates an APF (Automatic Purge Filtration) wash system to provide the correct amount of clean water for efficient wash performance. The front loading KitchenAid Duet washer determines the optimal water level and energy usage for every load, saving up to 22 gallons (almost 2/3 more water) per load than a traditional washer.
- Solar Rainwater Spa – The outdoor spa utilizes water from the rainwater catchment system that is heated by solar thermal panels mounted on a trellis above the spa.

Material Efficiency

- Construction Waste – 75% of all construction and demolition waste is recycled.
- Efficient Manufacturing – The selection of many products is influenced by the sustainable nature of their manufacturing processes, such as Andersen Windows, who has reduced landfilled solid waste and Milliken Carpets, who recycles nearly 100% of all its waste cuttings.
- Recycled Content – Internal walls are constructed of recycled gypsum sheetboard while the building façade uses General Shale bricks which were fired by waste fuel. Andersen Window's Fibrex material is a blend of synthetic material and wood fiber reclaimed from the manufacturing process. Durable "Kirei Board" is made from a significant stalk waste product from sorghum, used to make molasses.
- Recycling – Built-in recycling bins facilitate ongoing recycling throughout the home's life. An outdoor composting system provides hygienic means of composting organic waste onsite.
- Certified Wood – National certification programs like SFI (Sustainable Forest Initiative) and FSC (Forest Stewardship



Council) promote sustainable harvesting techniques and ensure that our forests remain healthy and diverse.

- Engineered Wood – Weyerhaeuser's certified sustainable wood reduces the amount of large, older growth wood that is needed; I-joists, beams and sheathing can use composites of smaller pieces of wood glued together.
- Salvaged Wood – Cape Fear Riverwood salvages trees sunk in rivers and reclaims wood from old tobacco warehouses to produce beautiful heart of pine hardwood floors local to the job site to lower embodied energy.
- Environmentally-friendly production materials – ElkCorp roofing shingles are a "hybrid" shingle, offering the mainstream look of attractive shingles and manufactured with significantly less petroleum than traditional asphalt shingles. It is critical to have a sustainable designer on board to help the project design and make informed and appropriate interior selections. Cline Design provided this invaluable guidance for the Mainstream GreenHome.
- Local/Regional Materials – Cape Fear Riverwood is salvaged 130 miles from the GreenHome site, while General Shale bricks are manufactured only 45 miles away. Using locally and regionally sourced materials significantly reduces the amount of energy consumed during transportation. The Elk shingles require less energy for transportation due to reduced material weight.

Indoor Air Quality

- Supply Air Filtering – Fine air filters (with a MERV value > 12) in the home's ventilation system capture most contaminants to achieve an exceptional level of indoor air quality.
- House Foundation and Mold – Extensive waterproofing on the exterior of the foundation wicks water away and into a drain. This feature ensures no water can permeate the foundation to threaten its structural stability and limits the risk of mold growth.
- Low-VOC Products – 95% of all interior products such as paint, Milliken carpet, and Henkel adhesives and caulks contain little or no volatile organic compounds (VOCs), common elements in household items that can severely affect air quality.
- Radon Mitigation System – A radon mitigation system enables any potential radon gases to escape from the basement - piping any potential rising radon gases from below the basement slab and vents it directly to the outside. This easy and inexpensive feature.
- Garage Sealing – The garage is completely sealed and insulated

from the rest of the house to ensure that any vehicle emissions do not enter the home.

- Air Testing – Indoor pollutant levels will be tested prior to home occupancy to confirm that results of the various indoor air quality improvement strategies implemented in the home.

Research

The project will serve as a living laboratory for a variety of currently available green technologies. In a conventionally built home, it is unlikely that the selected products would be applied collectively in a single home, but rather a subset of the products would be assembled to create a cost-effective package of green features. Certain features will save upfront construction costs (e.g., advanced framing reduces cost of framing wood, a tight envelope reduces expense of larger HVAC system). Certain features like Dawn Solar’s hot water system will “payback” within a fairly short period of time, for example within the 5-7 year average period a person owns a home in the U.S. These features would be considered rational economic investments today.

Other features are currently estimated to payback over a longer time horizon, but such a horizon is expected to shorten considerably with the advent of new technology and advanced manufacturing techniques that come from larger and larger purchase orders and demand. Of course, payback is most commonly measured in dollars saved, but it should also be measured using factors such as occupant productivity and lower health care required that are derived from a healthier, more livable environment.

Attention to sustainability metrics, such as energy and water conservation and indoor air quality will continue after construction is complete, and data will be shared with a broad audience. In addition to these metrics, Cherokee will analyze the cost component of each of the green products in the home. The hope is that the GreenHome will encourage wider scale implementation of these technologies, effectively helping to drive down the manufacturing and ultimate retail costs of the products.

The lessons learned from the GreenHome™ will be applied to Cherokee’s projects around the world. The relationships built through this project will greatly enhance Cherokee’s ability to more effectively green its large projects.

More broadly, the hope is that this project will help dispel common misconceptions about green building and guide the national homebuilding industry and the public toward healthier, more efficient design and construction.

The Meadowlands Golf Village

One of the first places Cherokee will apply the concept of mainstreaming green building and sustainable development on a large scale is in New Jersey, as part of its Meadowlands project. In the Meadowlands, Cherokee is building what is expected to be the nation’s first LEED-certified train station, constructing an environmentally-friendly bridge and encouraging its partners to maximize green building techniques for the residential units.

The “green” bridge over Berry’s Creek will be representative of the link between our new greening efforts and our traditional remediation goals. The bridge will be built over waters that will have been cleaned up by the established remediation techniques Cherokee is known for. Our cleanup of the area landfills and the implementation of a leachate collection system will enhance the surrounding wetlands and clean up the severe pollution that has plagued the area for decades.

For Cherokee, the principles and goals on which the company was founded have evolved, placing an even greater importance on the overall sustainability of redevelopment sites.

One site at a time –and now one home, bridge and transit station at a time – Cherokee hopes to make a significant impact on the health of the world’s environment.

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