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Home Energy Rating Certificate
Final Report

Rating Date: 2019-02-15
Registry ID: 306743827
Ekotrope ID: q2Rr-kbY2

HERS® Index Score:
24
Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings
\$2,627
*Relative to an average U.S. home

Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	26.7	\$594
Cooling	1.5	\$45
Hot Water	12.9	\$123
Lights/Appliances	27.0	\$707
Service Charges		\$185
Generation (e.g. Solar)	28.7	-\$848
Total:	68.1	\$805

HERS Index

Home Feature Summary:

- Home Type: Single family detached
- Conditioned Floor Area: 2,385 sq. ft.
- Number of Bedrooms: 5
- Primary Heating System: Air Source Heat Pump • Electric • 9 HSPF
- Primary Cooling System: Air Source Heat Pump • Electric • 15 SEER
- Primary Water Heating: Water Heater • Natural Gas • 0.96 Energy Factor
- House Tightness: 140.0 CFM50 (2.14 ACH50)
- Ventilation: 128.0 CFM • 20.0 Walls
- Duct Leakage to Outside: 53 CFM25 (3.1 / 100 s.f.)
- Above Grade Walls: R-19
- Ceiling: R-19
- Window Type: Vinylated Roof: R-26
- Foundation Walls: U-Value: 0.28, SHGC: 0.19
- R-16

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On the Cover

Located along the French Broad River and developed around a historic working farm, Olivette is a 346-acre planned community which requires all homes to use geothermal heating and cooling as well as attain a Home Energy Rating System (HERS) Score of 55 or lower.

A SHOT ABOVE PHOTO

Dedication

Our community lost two of its leaders in the first half of 2019. This directory is dedicated to their memories. Their work and service will live on and continue to improve the lives of future generations.



As co-owner and vice president of Equinox Environmental, Steve Melton was a devoted conservationist who doggedly pursued his passion for environmental protection each and every day. Steve worked to bridge the gap between human beings and their

interaction with and understanding of the natural world. That passion was exemplified through Steve's projects in restoring ecosystems, improving water quality, protecting land and building partnerships.



A leader in the field of landscape architecture and a mentor to many, Luther Smith improved the aesthetics, walkability and viability of Hendersonville. His firm, Luther E. Smith & Associates, led the Downtown Hendersonville Main Street Streetscape Rehabilitation Project and earned an award for Best Outdoor Space Improvement in the 2014 NC Main Street Awards Competition. Luther also served RiverLink as a champion for the revitalization of the French Broad River and its watershed for decades.

interaction with and understanding of the natural world. That passion was exemplified through Steve's projects in restoring ecosystems, improving water quality, protecting land and building partnerships.



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bobbi.holland@nestrealty.com

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amanda.boren@nestrealty.com

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BETH ZABRISKIE

THE BETH & KAT TEAM

beth.zabriskie@nestrealty.com

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Welcome to the Directory

There is something special about living in an area where people get it. There are many areas in this world where a conscious community shares a deep desire to protect the earth, help those in need, include all people, and work in service of present and future generations. Western North Carolina is one such place, and we are fortunate to live, work, and play here.

At Green Built Alliance, our staff and Board of Directors dedicate each day to advancing green building, growing the clean-energy economy, serving low-income families through energy upgrades, and responding to the climate crisis.

The political and moral challenges of our times have motivated us and inspired our organization to grow and evolve. We have hired new staff, expanded programs, and built collaborative relationships with an incredible array of allies, from citizens and nonprofits, to businesses and local governments.

In 2020, we are releasing a new version of our Green Built Homes certification program. Thanks to a grant from the Kendeda Fund and leadership from our board, we have incorporated many new regenerative design elements into this version. It will push building professionals to the next tier of what is possible in designing and building a home. This is a call to make our homes a living model of sustainability, and continue to improve the industry and the lives of those we serve. Learn more about our enhanced focus on regenerative design within Green Built Homes on page 31.

We are working daily to promote clean-en-



The staff of Green Built Alliance: (from left to right) Assistant Field Technician Riley West, Blue Horizons Project Coordinator Sophie Mullinax, Energy Efficiency Program Manager Jonathan Gach, Energy Savers Network Operations Coordinator Yulia Shaffer, Executive Director Sam Ruark-Eastes, Outreach and Resource Coordinator Hannah Egan, Community Engagement Director Cari Barcas and Program Director Maggie Leslie. PAT BARCAS PHOTO

ergy programs in the broader community through the Blue Horizons Project. This community collaboration assists residents and businesses in finding resources to lower their energy use, install solar panels, and cut utility bills. We need to move away from fossil fuels and transition to clean energy and storage. This will require everyone taking action each day in small and large ways. For resources on how you can improve your home or business through clean-energy programs, tips, and resources, visit bluehorizonsproject.com.

The Blue Horizons Project will also help more than 300 low-income families improve their homes in 2019 with energy-efficiency up-

grades as well as health and safety improvements through our partnership with Energy Savers Network, a grant from the Southeast Sustainability Directors Network, and funding from Buncombe County. The families we help are disproportionately burdened by their energy bills and live in some of the least efficient houses and mobile homes in our area. This work is completed with some staff and many volunteers in partnership with other organizations on a weekly basis. This is what a healthy response looks like to the intersection of climate and poverty. Learn more about Blue Horizons Project and its low-income programs on page 50.

ability topics. An overview of the eight-workshop series scheduled between August and December of 2019 can be found on page 31. We hope you will join us at one of these workshops or a future educational offering from our nonprofit.

The seventh annual CiderFest NC will be held Saturday, Oct. 12, 2019 at Carrier Park. This has been such a fun and successful fundraiser for Green Built Alliance, and we hope you will come celebrate with us this fall.

Many thanks to our long-term members and supporters. Without you, we couldn't do this work. To those of you who are new to our organization, we are grateful you have joined this collective effort to advance sustainability in the built environment. For those of you interested in becoming part of the solution, we invite you to connect with us and explore opportunities for involvement by visiting greenbuilt.org or emailing info@greenbuilt.org. We look forward to hearing from you.

Enjoy these pages full of inspiring stories and technical know-how written by your friends and neighbors, and thank you for being part of our community.



As the latest beneficiary of our Appalachian Offsets program, the Isaac Dickson Elementary School solar power project is approaching its final stage of fundraising before installation. We have had many local individuals and companies offset their carbon footprint to support this awesome local renewable-energy project. Read our story on page 60 and visit cutmycarbon.org to learn more.

We are organizing high-quality workshops taught by brilliant people who can help further your know-how of cutting-edge sustain-

Connect with Us and Explore Our Online Resources:

@ greenbuilt.org  facebook.com/greenbuiltorg  instagram.com/greenbuiltorg  twitter.com/greenbuiltorg



Located at Olivette Riverside Community and Farm, this Platinum Net Zero Green Built Home achieved a HERS Score of 1 and won the Asheville Home Builders Association's Green Certification Award in its 2018 Parade of Homes. COURTNEY HALL PHOTOS

Holding the Vision

The Winding Road to Our Dream Green Home

BY MARY LOVE

My wife Deb and I moved to Asheville in 2003 with the dream of building green homes around a farm.

At the time, green building was a new concept and investors were wary. Having grown up on a farm, I wanted to preserve land, but most investors thought the idea of keeping a working farm within a residential development was insane.

Synchronicity led us to buy the first ENERGY STAR®-certified house in Buncombe County. We thought this would be a temporary home while we looked for the perfect place to build. Little did we know how long our journey would be.

Around the same time, Green Built Alliance—then known as the Western North Carolina Green Building Council—was developing a certification program for green homes, which came to be known as Green Built Homes. By providing education to builders, Realtors

and homeowners, this program moved green homes into the local spotlight. A few infill projects and surrounding suburban developments began requiring that all houses be certified, and some land was being placed in conservation.

Over the course of the next 16 years, Deb and I viewed developments and houses, which offered many good features yet were always lacking in some way.

When I heard of the 346-acre community being planned around a historic farm at Olivette, I was excited by their master plan. I was also dubious, in knowing the reality of what it would take to create a planned community that required a Home Energy Rating System (HERS) Score of 55, geothermal, and a list of environmental requirements, plus included a working farm. Finally, an agrihood community was being created!

I started taking my real-estate clients to Olivette and became more impressed with the master plan and the developer's commit-

ment. After helping some clients buy lots, I decided to take Deb to see it in January of 2018. She immediately loved it.

During the next few months, we walked the land, visualized what life would be like and dreamed of the perfect house. By April, we were under contract for the first house on the community's farm side, known as Westridge Hamlet.

A local builder had created land-home package deals. All homes had to be Green Built Homes certified, featuring a modern farmhouse with open floor plans. This made the building process so much easier. We knew from the start that our house would have the internal sustainable and energy-efficient features that are so important.

The foundation was made of insulated precast concrete wall panels that provide a home with an excellent thermal envelope, minimizing the potential for energy leakage.

The development requires ge-

othermal heat pump uses the earth all the time, without any intermittency, as a heat source in the winter and a heat sink in the summer. This design takes advantage of the moderate temperatures in the ground to boost efficiency and reduce the operational costs of heating and cooling systems.

Heat pump water heaters use

Project Team

- Builder** — Osada Construction
- Foundation** — Superior Walls of North Carolina
- HVAC Contractor** — Forest City Heating and Air
- HVAC Equipment** — 3 Ton Trane Water Furnace System
- Ventilation Equipment** — Panasonic WhisperGreen Select continuous bath fans upstairs and downstairs
- Electrician** — Blue Ridge Electrical
- HERS Rater** — Vandemusser Design



The home's main level features a large living area as well as the kitchen, complete with LED lighting, WaterSense fixtures, and ENERGY STAR® appliances including a convection/induction range.

electricity to move heat from one place to another instead of generating heat directly. Therefore, they can be two to three times more energy efficient than conventional electric resistance water heaters. To move the heat, heat pumps work like a refrigerator in reverse.

A desuperheater is a small, auxiliary heat exchanger that uses superheated gases from the heat pump's compressor to heat water. This hot water then circulates through a pipe to the home's storage water heater tank.

A feature we enjoy is that the heat pump water heater also acts like a dehumidifier and instead of turning the air conditioning to a

Video Tour



Watch a behind-the-certification video tour of Mary Love's Green Built Home at greenbuilt.org.

lower number, we open the mechanical room.

Our appliances are ENERGY STAR® and our water fixtures and toilets are WaterSense. All lighting fixtures use LEDs.

Once we had maximized our energy-efficiency selections, it was time to think about solar power. We discussed whether to get back-up batteries right away or to wait. Two factors caused us to

wait: first, if we got batteries immediately, then we would not receive the rebate from the local electric company, and second, technology is currently progressing so quickly that batteries installed today may be obsolete in a few years. We decided to wait on batteries and go with a 7.7 kW solar array. The panels are solid black and almost invisible on our black metal roof.

Indoor air quality was an important consideration for us. We already knew we would have fresh-air filtration and that all glues, stains and paints would be low or zero VOC. We also decided to use AirRenew, a new drywall product that absorbs formaldehyde and converts it into a safe inert compound.

We only had to make one emotional decision and fortunately, science helped influence my wife. Deb is a fabulous cook and enjoys cooking on a gas range. We were aiming for a low HERS Score and decided to go with a convection/induction range. (Deb is now in chef heaven.)

Our aim was to create the greenest home possible. We are delighted to brag that our home

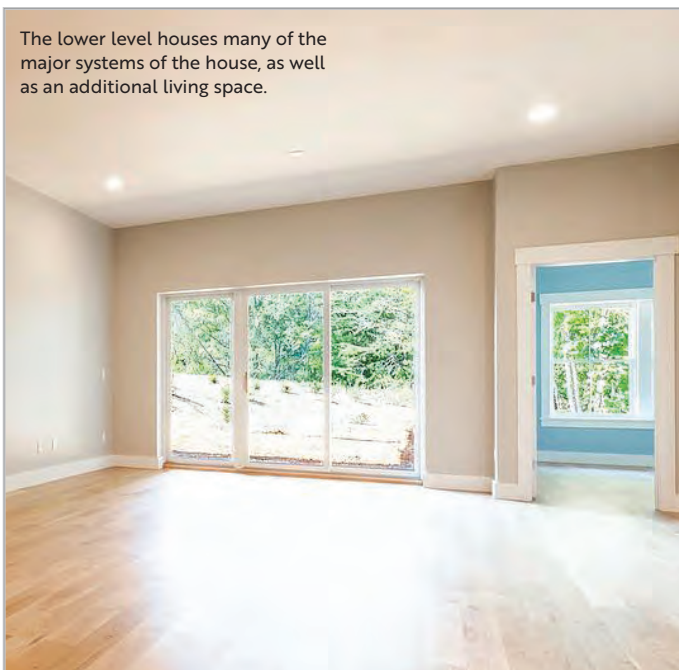
landed at a HERS Score of 1, achieved Green Built Homes' Platinum Net Zero level of certification, and won the Asheville Home Builders Association's Green Certification Award in its 2018 Parade of Homes.

We recently moved into our new home. We are enjoying all the designed comforts and the ability to walk our dogs on numerous trails every day.

When I wake up in the morning, I sit in my rocking chair, enjoying the features of my new home, and then look out my window to see a working farm that I'm part of.

It was so worth the wait. Deb and I held our vision for 16 years. We are deeply grateful for everyone who made our dream come true.

Mary Love has been living and teaching the green life for so long that she has affectionately been called the "Grandmother of Green." Her love for nature and sustainability naturally developed from her early years growing up on a farm. Mary is president of Love The Green real-estate consulting firm. Connect with Mary at lovethegreen.org.



The lower level houses many of the major systems of the house, as well as an additional living space.



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A Net-Zero Adventure

Setting New Records



Incorporated into the structure of the home is insulated oriented strand board (OSB) sheathing with continuous insulation across the home envelope. The windows and doors were strategically designed with both double- and triple-paned glass, and open-cell spray foam fills 2x6 exterior walls to create a well-insulated and air-tight barrier. RYAN THEEDE PHOTOS

BY RAYMOND THOMPSON

There are many ways to link in to the green revolution.

A person can focus on energy consumption, human rights, individual health, environmental protection or a little bit of everything at once, but it is generally driven by a calling in the primitive heart.

This is a tale of how a force of 50 to 100 workers (excluding several hundred offsite producers and innovators) integrated this calling into the Schmeltzers' home, while factoring in local and global economic constraints.

Our journey with Sally and Jason Schmeltzer began in 2017 as they started sifting through local high-performance design-build firms to fulfill their desire for a net-zero energy home.

Guided by the Schmeltzers' commitment to energy efficiency in every decision and product selection, we were able to build a home attaining ENERGY STAR® accreditation and Green Built Homes Platinum Net Zero Energy level certification.

The Schmeltzer home even achieved the lowest Home Energy Rating System (HERS) Score that the Green Built Homes program had seen within any certified project at that time: -10. This was beyond all of our expectations, and

the Schmeltzers' commitment carried the day!

The vision

Sally and Jason moved to Asheville in 2005 to begin their careers as chemistry faculty at the University of North Carolina at Asheville.

As a couple and in their professional work, they always endeavor to make decisions that make a difference (both big and small) for their family, colleagues, students, community, and overall global footprint. This life approach is reflected in their choices to own only one car, join a local Community Supported Agriculture (CSA) program, adopt rescue dogs and prioritize family time.

After living in a 2,400-square-foot home for more than a decade, the Schmeltzers made the choice to create a home with a much smaller impact on the planet for their daughter and generations to come. After much building-science research, they set their sights on building a new, net-zero energy home.

"It was our dream to have a net-zero energy home for two reasons," Sally said. "First, the energy impact; if we could balance the resources our family was using and at least come out even, that would

be better for the environment. Second, we saw it as an important financial investment. If we were going to put our funds into a new house, it made sense to us to have one that will be really energy-efficient in 20 or 30 years from now when energy costs go up."

The couple bought an infill lot with ideal southern exposure in Weaverville, a community that radiates small-town appeal. As the builder, we were passionate about their vision and eager to make their dream a reality. After several design iterations, we arrived at a traditional-contemporary design of a 1.5-story, 1,750-square-foot, 3-bedroom, 2-½-bathroom home.

The Schmeltzers and our project team were deliberate in selecting the most energy-efficient materials and mechanical systems available for the home and budget. The result was an all-electric home, removed from relying on fossil fuels for its operation.

As the project unfolded, we offered the option to upgrade whenever it became apparent that there was a way to achieve greater efficiency at a reasonable cost, and the Schmeltzers frequently accepted the opportunity, which resulted in a higher performance home than we initially set out to achieve.

Project Team

Builder — Sure Foot Builders
HVAC Equipment — Mitsubishi Electric
Cooling & Heating
Ventilation Equipment — Green R
HERS Rater — Vandemusser Design

The design

Incorporated into the structure of the home is insulated oriented strand board (OSB) sheathing with continuous insulation across the home envelope. The windows and doors were strategically designed with both double- and triple-paned glass, and open-cell spray foam fills 2x6 exterior walls to create a well-insulated and air-tight barrier.

These measures were all integrated into a cost-efficient budget with a light and airy interior aesthetic. We also installed a heat pump water heater in the sealed crawl space, which keeps the air-space dry and cool for efficient healthy storage.

Next steps included selecting an HVAC system. While owners typically think about aesthetic choices when building a new home, mechanical system selection is critical to ensuring the



A heat pump water heater is installed in the sealed crawl space, which helps keep the airspace dry and cool for efficient healthy storage.

home's performance, comfort and indoor air quality.

Like many homeowners, the Schmeltzers were accustomed to a ducted system with a natural gas furnace. To explore more efficient, healthier options, we sent them to an open house about variable capacity, split-ductless systems.

Utilizing variable-speed compressors, these systems can be ducted or ductless, are compact, offer zone control and use the precise amount of energy required to meet the comfort needs of the homeowner, thus providing optimized efficiency. Split-ductless systems deliver superior air filtration. Each indoor unit includes a washable, reusable filter, unlike traditional systems that typically have a single filter for an entire residence.

Once the HVAC designer calculated the loads of the home, four wall-mounted split-ductless units were specified, connecting to corresponding outdoor compressors — two upstairs and two downstairs.

We also used a jumper duct system, putting inline fans to deliver conditioned air to the closets and bathrooms — ultimately balancing the home's indoor atmosphere.

After beginning with a net-zero energy qualifying home design with a 21 SEER (Seasonal Energy Efficiency Ratio) mini-split system, our HVAC supplier offered an alternate configuration that boosted the home to above 30 SEER. The Schmeltzers jumped at the opportunity. The units also have a high-performance heating capability, providing comfort in all rooms of their house even during Weaverville's chilly winters.

As the final step, we focused on indoor air quality.

A common issue with local high-performance homes is negative pressurization, from continuous running bath fans. High-performance homes tout healthier living environments with cleaner, less contaminated air, but negative pressurization can do the oppo-

site, causing harm to occupants or creating bigger issues such as mold, carbon monoxide back-drafting, and moisture concerns. Many builders simply install a continuous running bath fan to qualify their home for green certification. Homeowners frequently disconnect after purchasing the home, which results in unhealthy indoor air quality.

That said, we used an Energy Recovery Ventilator (ERV) for balanced and continuous fresh air for the home, which we install on every residential project.

With efficient materials and mechanical systems plus an airtight thermal envelope, one more step was needed to achieve net-zero energy: solar generation. By the end of construction, the Schmeltzers had a photovoltaic system added to their roof and connected to the electric grid.

The net

With their solar generation, the Schmeltzers will actually net positive in warmer months, supplying the grid with energy.

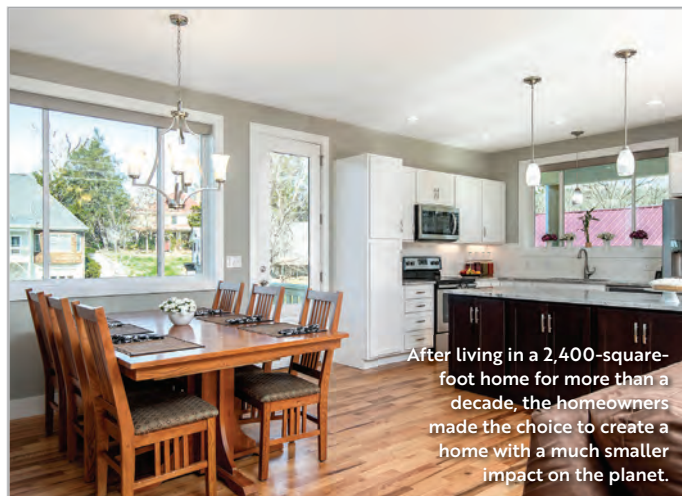
"We officially moved into the house in October 2018 and started monitoring our usage then," Sally said. "For the month of February

2019, we produced about 600 kWh of energy; for the month of April, we produced 940 kWh."

In making the jump to build a highly-efficient home, the Schmeltzers have also reaped rebate benefits. Duke Energy provided them with a \$3,600 solar rebate, paying a percentage for every kWh generated. They also received a federal tax rebate for building a new-construction home with a photovoltaic system.

This home is a testament to one family's commitment to high-performance building as a way to secure a better future. Homeowners skeptical about the investment of energy-efficient systems and materials should consider the impact on the planet, the health of their home and the long-term savings in their wallet, as well as the calling of the primitive heart to do better.

Raymond Thompson was carved from the concept that a buffalo robe is the best home ever built. He spent years living on bicycles and in cars across the U.S. and Mexico. He is now on a quest for a future to pass on to his children. Raymond is the owner of Sure Foot Builders. Connect with Raymond at surefootbuilders.com.



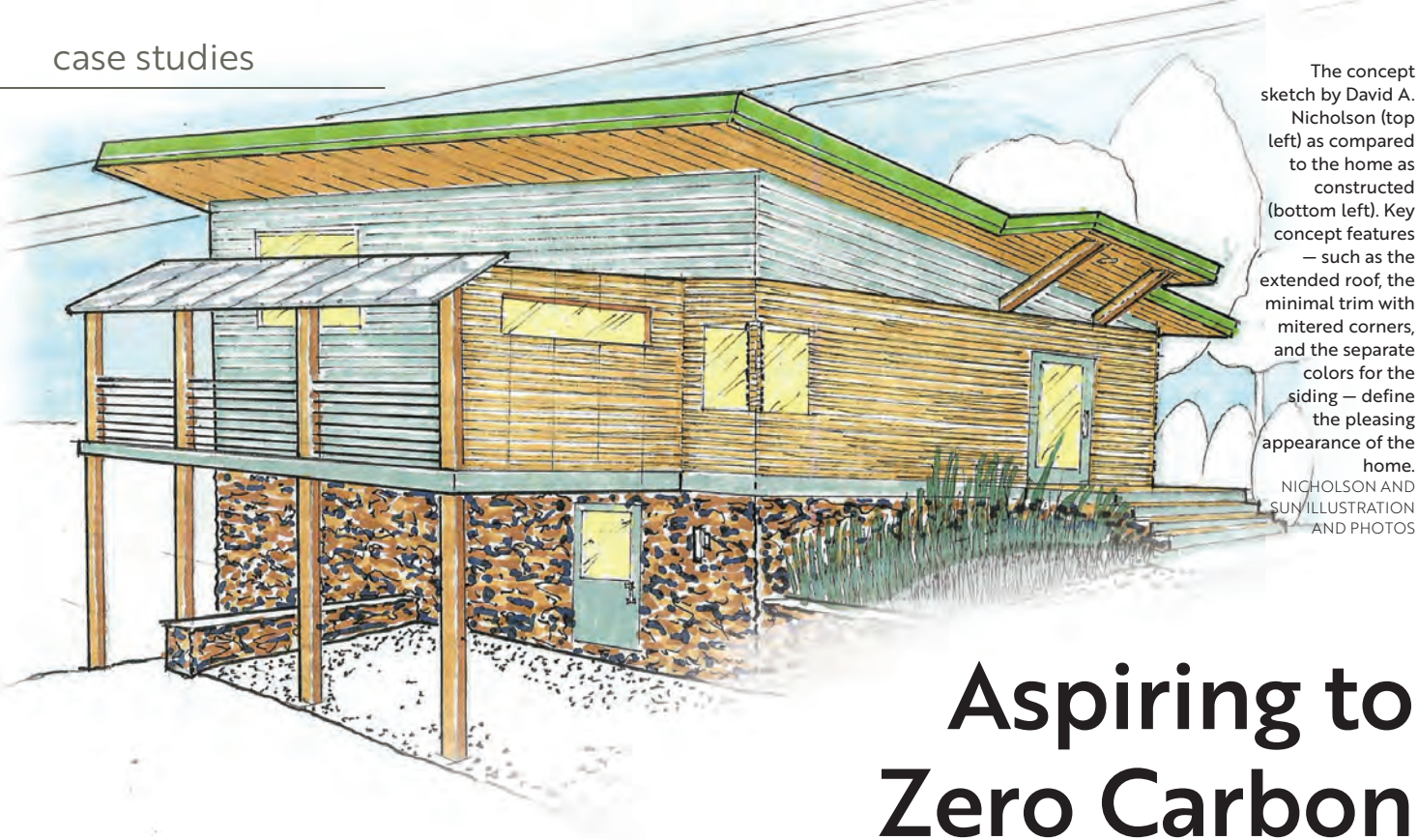
After living in a 2,400-square-foot home for more than a decade, the homeowners made the choice to create a home with a much smaller impact on the planet.

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#LoveTheGreenTeam #BuiltItGreen



The concept sketch by David A. Nicholson (top left) as compared to the home as constructed (bottom left). Key concept features — such as the extended roof, the minimal trim with mitered corners, and the separate colors for the siding — define the pleasing appearance of the home.
 NICHOLSON AND SUN ILLUSTRATION AND PHOTOS

Aspiring to Zero Carbon

First Net-Zero Home Certified in Green Path Commons

BY DON NICHOLSON

Can we build a zero-carbon-footprint neighborhood? It's a challenge.

We are attempting this at Green Path Commons in West Asheville. The neighborhood will have seven net-zero homes; the first is at 9 N. Belgium Lane. A second net-zero home at 17 N. Belgium Lane is almost complete.

Across from the first home is the classic 1905 farm house that was originally on the parcel. The farm house has improved insulation and 2kW of solar, but is not net-zero. It will be the only home that is not net zero. This makes sense from a carbon standpoint; reuse is generally best because of the lost embedded energy (carbon) in demolition and rebuilding.

The neighborhood is designed to foster a small community with a common interest in sustainability. A picnic pavilion overlooks a common area with fire pit, garden (including 500-gallon rain collection and groundhog-proof fence!), as well as other shared assets.

The design process for 9 N. Belgium Lane began with a concept sketch. The design was refined in the planning stage and as the building process proceeded, and ultimately achieved Green Built Homes' Platinum Net Zero level of certification.

The home was constructed with a highly insulated, double-wall system — sort of like building a house inside a house. The envelope walls have almost no thermal bridging and no thermal weak points due to electrical or plumbing hardware. The "house inside a house" system makes it easy to achieve dramatic cantilevered eaves and porches without a bulky roof.

Solar panels are mounted on an eye-catching, skew awning that allows them to point directly south even though the house is oriented 45 degrees from that direction.

With 3.5kW of solar, the home has a Home Energy Rating System (HERS) Score of 14. Having a HERS Score this low allows the home owners to be net zero over the course of the year by being energy conscious.

Contributing to the low HERS Score are high insulation values and low air infiltration that allow the home to be heated and cooled with very efficient mini-split heat pumps. Heat pump technology is also used to dry laundry and heat water efficiently.

This home has a much lower carbon footprint than a typical



Project Team

- Builder** — Nicholson and Sun LLC
- Insulation** — Pisgah Insulation
- HVAC Contractor** — R&C Heating & Cooling
- HVAC Equipment** — R. E. Michel Company
- Solar Photovoltaic System** — C. M. Wilson Inc.
- Solar Structural Engineer** — Twin Hills Structures Inc.



The master plan for the Green Path Commons neighborhood shows the layout of existing homes (9 N. Belgium Lane, 17 N. Belgium Lane, and 350 Emma Road) as well as proposed houses (21 N. Belgium Lane, 340 Emma Road, 342 Emma Road, and 354 Emma Road). The common area is also shown, including a garden, fire pit and pavilion.

home because no concrete is used in the foundation. Instead, many tons of local gravel are used to make a strong base for the home (consider the way gravel supports train tracks; trains can weigh 20,000 tons).

We emphasize the use of wood because employing wood sequesters carbon, keeping it from becoming carbon dioxide in the atmosphere.

For parking, driveways, and roads, we use gravel and asphalt to reduce the carbon footprint of Green Path Commons.

It is very difficult to assess a home's carbon footprint. Realistically, all we can do is make every decision with the goal of reducing the carbon footprint.

We support a federal price on carbon (fossil fuels) as proposed in the Energy Innovation and Carbon Dividend Act that has been introduced in Congress. A properly implemented price on carbon will simplify efforts to reduce residential carbon footprints because carbon will be reflected in the price of carbon-intensive materials like concrete. It will also give homebuyers more cash to spend on solar panels and energy efficient upgrades.

In the near future, residential electric-vehicle charging will become common. We are excited about the possibility of building homes at Green Path Commons that have vehicle charging capacity provided by solar.

The economics of solar charg-

ing is difficult because the amount of energy needed for vehicle charging will depend on the number of miles traveled. Furthermore, if the house is sold to someone without an electric car, there needs to be a way for them to utilize the excess capacity.

Electric cars are becoming more common; Duke should change its interconnect structure to buy back excess solar power.

Green builders should be pushing for change on renewable-energy policy with the utilities and government at the local, state, and national levels. Green builders have a responsibility to lead the movement to lifestyles that do not depend on fossil fuels.

Net-zero homes influence behavior, and inspire owners to apply the net-zero approach to transportation and other lifestyle choices.

As "Climate City," Asheville should be at the forefront of this movement.

Don Nicholson is retired from Oak Ridge National Laboratory, where he was a theoretical physicist for thirty years. He continues to work in that field as a research professor in the Department of Physics and Astronomy at the University of North Carolina at Asheville. In 2015, he and his son, Donald, formed Nicholson and Sun, a residential building company dedicated to climate solutions.

Connect with Don at nicholsonandsun.com.



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Learning New Tricks

*Lessons from WNC's First
DOE Zero Energy Ready Home*



A Department of Energy Zero Energy Ready Home was recently completed locally as the first in Western North Carolina. LEIGHA DICKENS PHOTOS

BY LEIGHA DICKENS

The Department of Energy wants builders to up their game.

Though it's worth celebrating the energy savings achieved by the DOE's ENERGY STAR® Homes program (said to be 20 percent), it's possible to build homes that are even more efficient than that. It's also possible to do so while also delivering other key benefits: improved comfort, reduced water use, the best possible indoor air quality, and the ability to seamlessly integrate a photovoltaic system.

Enter the Zero Energy Ready Home (ZERH) program. Launched in 2013 as an outgrowth of the DOE's Builder Challenge program (which saw 14,000 homes certified), this new home certification program's requirements go several

steps above ENERGY STAR®.

As of late 2018, there were several thousand certified homes across the country, with approximately 10,000 in the pipeline to be certified. As a builder focused on high-performance homes with Home Energy Rating System (HERS) Scores already right within the target range (45 to 55 pre-solar), we were ready to try it out on a new project of ours in Mills River.

Like ENERGY STAR® with add-ons

The insulation and comfort system requirements for ZERH are a bit beefed up from ENERGY STAR®, but in our case, we were already doing most of those.

The biggest design difference is that ZERH requires all ductwork to be 100 percent inside the con-

ditioned space, whereas ENERGY STAR® merely rewards it. This makes sense, as moving ductwork inside the conditioned space offers notable energy-efficiency gains; one study found it can save between 8 and 15 percent on air-conditioning costs.

As designed, the Mills River home has 1,762 square feet on a slab foundation, incorporating a split mono-slope roof design with vaulted trusses.

We typically build a conditioned attic space with a flat ceiling over a central core of hallways and bathrooms, using spray foam insulation at the roof line and exterior attic walls. We usually house a single ducted mini split in this space, with ductwork adequate to serve the bedrooms and bathrooms that are all clustered on the

back half of the house.

We then serve the other half of the house — the open kitchen, living room, and dining room — with a single ductless mini split. This two-zone system is our attempt at striking a compromise between right-sizing the unit's capacity to

Project Team

Builder — Deltec Building Co.

Floor Plan and Panelized Home Kit — Deltec Homes (base plan design by S Square Design Studio)

Ventilation Equipment — Green R

HVAC Equipment — Mitsubishi Electric Heating and Cooling

HERS Rater — Vandemusser Design

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the house's heating and cooling load with the need to distribute the conditioned air effectively throughout the house.

The reduced hot-water use requirement

The ZERH checklist states: "To minimize water wasted while waiting for hot water, the hot water distribution system shall store no more than 0.5 gallons of water in any piping/manifold between the hot water source and any hot water fixture."

Since most homeowners flush this cooled water down the drain while they wait for the heated water to arrive, this requirement can save a considerable amount of water. Yet a water heater would have to be located close enough to all the faucets to succeed at storing this little water in the piping between them. Paying attention to water stored in hot water piping

may be new to many builders.

A quick glance at the floorplan had me convinced at first that this project was not going to succeed at this, as the water heater was on the opposite side of the house from the bathrooms. Yet we had specified a heat-pump water heater for its superior energy performance over a typical electric tank water heater. The homeowners agreed to this technology despite the operating noise and the cold air, on the condition that they could keep this water heater away from the main living spaces.

I hated to give up the heat-pump water heater, so I spoke to the friendly folks at the DOE about this challenge. They pointed out that ZERH does allow the use of a hot water recirculation system to meet this requirement, so long as that system has the right kind of controls.

In a typical hot water recircula-



The ducted mini split with short duct runs fits inside a small conditioned attic space. ZERH certification requires all ductwork to be inside conditioned space.

tion system, an extra hot water return line makes a loop between the furthest fixtures and the water heater, while a pump is set up to circulate hot water throughout this loop. When hot water is called for, the heated water only has to travel the distance from the loop to the faucet, not the entire distance from the water heater to the faucet, reducing the amount of water that is wasted down the drain while waiting for the hot water to arrive.

The thing is, many of the common methods of controlling a hot water recirculation pump (such as timers or temperature sensors, or even just leaving the pump on 24/7) ultimately waste considerable energy, as these systems end up operating when hot water is not actually needed. To avoid this, in a ZERH home, the pump must be controlled by either a manual button, an adaptive control system, or an occupancy sensor that turns the pump on when it senses someone near the faucet. We settled for a system with a manual control.

A focus on interior finishes

ZERH certification requires that the homeowner also earn EPA Indoor Air Plus Certification.

Any composite wood product (including cabinetry, sheathing, trim material, laminated veneer lumber, or engineered wood flooring that had a composite wood component), any interior paint or stain, and any carpet and even the carpet pad have to comply with a relevant indoor air quality standard.

While some of these standards were easy to identify (for example,

the carpet product the homeowners already selected had the required Carpet and Rug Institute green label clearly documented on the spec sheet, and our paint supplier was already using the Sherwin Williams Pro-Mar 200 Zero-VOC line), others required considerable research to uncover. Ask, verify, and then verify again is a good mantra for this kind of product specification research.

Solar-ready

In our case, solar was already part of the project. Our area has a decent net-metering program, and the homeowner wanted to take advantage of local rebates for solar offered through Duke Energy. Without solar, a home participating in ZERH has to complete a solar-ready checklist which include provisions for planning for future solar.

Benefits and considerations

In the end, the homeowners got a highly efficient home with tested systems, better air quality, and reduced hot water wait times. Because we were willing to do our research (and the homeowners were open to it), we were able to do so without compromising on the specific technologies (like the heat-pump water heater) or the specific selections (like those cabinets they really had to have). We, meanwhile, gained a few new tricks and practices to employ.

Leigha Dickens manages green building and building science for Deltec Homes, a high-performance home panelizer and builder in Asheville. Connect with Leigha at deltechomes.com.



The heat-pump water heater is located in a utility space, kept away from bedrooms and baths at homeowner request to minimize the impact of noise and cold air.



More than 40,000 handmade bricks were used in this Beaucatcher Heights project. SCOTT HUEBNER (BRICKSTACK ARCHITECTS) PHOTOS

BY GARRET K. WOODWARD
When reflecting on the recent completion of his first net-zero home, Kevin Hackett still marvels at the number of bricks that went into the project. "It must have been over 40,000 bricks," chuckled Hackett, the president of Asheville-based Longview Builders. "It's a very modern house, where you wouldn't normally see brick. There's probably more brick on the inside than on the outside.

The foundation is massive, and with a lot of steel used." The material used seems only fitting when taking into account that the homeowner runs the Old Carolina Handmade Brick Co. in Salisbury, where the bricks were custom-made at 1.5 inches tall and 18 inches long. The 3,000-square-foot house sits on three-quarters of an acre in the new Beaucatcher Heights development in the Kenilworth neighborhood of Asheville.

"Like concrete, the longevity of brick is unmatched," Hackett said. "There's not a product out there that has a higher longevity than brick. It will last forever. From an exterior, maintenance and lifespan of the product, it's pretty unbeatable." Longview Builders tries to implement standard green-building practices on all its projects, and Hackett saw the sustainability thread carry through in the use of brick.

Project Team
Builder – Longview Builders
Architect – Brickstack Architects
Interior Design – Lisa Sherry Interiors
Solar – Sugar Hollow Solar
HERS Rater – Vandemusser Design
HVAC – Gentry Heating
Brick – Old Carolina Handmade Brick Co.



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The home has a high-efficiency HVAC system and on-demand water heater.

alongside high-efficiency argon-filled windows, and you have a really efficient house to begin with, and you don't need much of an investment in solar to get to net zero," Hackett said. "All of those small upgrades are not that big of a cost, and that gets your house around 85 percent of the way to net zero. Then as the next step, you have to add some sort of renewable like solar — which we did — and that's what tipped us over to net zero."

For the heat pump, Hackett went with a Carrier Infinity product. With the federal tax credit for geothermal now long gone, he's found that the energy efficiency of modern heat pumps is on par with that of geothermal methods.

"With the progression of multi-peed variable compressors on the heat pumps systems right now, the heat pumps are just as efficient as geothermal," Hackett said. "The Carrier Infinity heat pumps when it's part of a multi-stage system are unbelievable. We're heating and cooling 3,000 feet of space for around \$100 a month."

Hackett said he makes a point to prewire each of his projects for solar, as it becomes increasingly likely that most homeowners will

Numbers and Features

- Walls with open-cell foam at around R20.
- All windows are Low-E Argon-filled Semco Windows.
- The house has a 97 percent Efficient Navian on-demand condensing water heater.
- HVAC is a Carrier Infinity Hybrid System with variable stage 20 SEER heat pump.
- The home's HERS score is 3.

want panels on their home in the near future.

"As the implementation and adoption of solar takes places on a more rapid progression across the country, the individual cost per watt of solar arrays will come down to a level to where it will be more affordable for more people," Hackett said. "In the meantime, builders have a responsibility to ensure the homes they're building currently are as efficient as they can be and really push to prewire for solar."

To learn more about Longview Builders, visit longviewbuildersinc.com.

"Old Carolina bricks are made from local clays that are quarried from outside of Charlotte, then shipped to Salisbury, where this independently owned company makes each brick by hand with a local workforce," Hackett said.

With a Home Energy Rating System (HERS) Score of 3, the proj-

ect achieved Green Built Homes' Platinum Net Zero level of certification. The main window wall uses 2-by-8 studs instead of 2-by-6, with spray foam in the ceiling, roof and exterior walls. The house has a high-efficiency HVAC system and on-demand water heater.

"You take all of those items



The main window wall uses 2-by-8 studs with spray foam in the ceiling, roof and exterior walls.

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Simple Shifts

How Creature Comforts Can Coexist with Sustainability

BY GARRET K. WOODWARD

At first glance, the new Green Built Home on Hawberry Court in Asheville appears to be a normal house with a lot of aesthetically pleasing qualities and spacious appeal amid its luxurious appearance.

"We built a pretty mainstream home," said Jody Guokas, owner of Asheville-based JAG & Associates Construction. "You wouldn't look at that house and think it's a super energy-efficient net-zero home. It just looks like a nice, custom home."

With three bedrooms and two and a half bathrooms on about an acre of land, the 2,400-square-foot home attained Green Built Homes' Platinum Net Zero level of certification and a HERS Score of 9. It

wasn't initially envisioned as a net-zero property, but it became such with a few tweaks by Guokas.

"The homeowners were interested in building a sustainable house, but they also just wanted a new home, so the design was not going to be driven by that desire for net zero," Guokas said. "One of my goals with building is that we don't have to make green or sustainable this funky, weird thing. You can achieve any sort of goal or style and make it sustainable. If you bring intention to become sustainable or net zero, you just have to make some design deci-

sions in that direction."

In terms of green initiatives in the design, Guokas followed the usual lines of ENERGY STAR® and Green Built Homes standards, which have become the standard for a vast number of new homes in the Western North Carolina area.

"Most of it was implementing our standard building practices," Guokas said. "It's all 2-by-6 exterior walls. It's going to be well air-sealed with increased insulation and air sealing in the roof system, as well as conscious of what kind of tight and energy-efficient windows we're

"You wouldn't look at that house and think it's a super energy-efficient net-zero home. It just looks like a nice, custom home."

Project Team

Builder — JAG & Associates Construction
Architect — Brent Campbell
Solar Installer — Sugar Hollow Solar
HERS Rater — Vandemusser Design

using and the kind of efficient HVAC system that's installed in accordance to those programs."

The house incorporates six inches of open-cell spray foam in the roof, R19 fiberglass in the exterior walls, and Superior Walls with an additional R19 in the basement, which makes the basement walls R31 (with R12 under the basement slab).

But Guokas didn't stop there and went the extra step to bring

A Green Built Home on Hawberry Court. RYAN THEEDE PHOTOS





The home incorporates six inches of open-cell spray foam in the roof and R19 in the exterior walls.

the home to net zero.

"With that baseline of Energy Star and Green Built Homes standards, it's going to bring a home much closer to a more exceptional mark like being net zero," Guokas said. "So, you take that baseline and add in some more initiatives — put more insulation in the roof system, install solar panels on the roof — and that's how you go from energy efficient to net zero."

Another key component to the property was its south-facing slope, which made for an ideal orientation with the passive solar design when the home was placed to aim toward the sun.

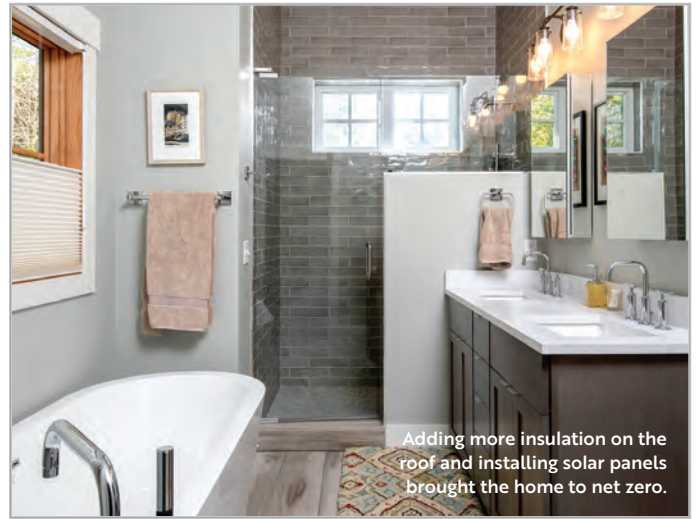
"It's a photovoltaic solar electric system. Basically, the only way to

get to net zero is to actually produce electricity on the home with solar panels," Guokas said. "We can make the house incredibly efficient, but, at some point, we still need power for the lights, refrigerators and appliances."

Although north-facing slopes are less ideal, Guokas says there can still be a path toward net zero on those properties.

"If you have a north-facing slope that has bad orientation, you'll have to do more insulation and solar panels because you're not getting as much free energy as the sun gives you on a good solar site," Guokas said.

While this project was a straightforward and easygoing



Adding more insulation on the roof and installing solar panels brought the home to net zero.

process, Guokas emphasizes how nowadays you can achieve net zero even within a relatively conventional house design — one that maintains creature comforts and room to move around.

"You can do a house that's fairly mainstream, but you can take that home and make it sustainable. For people who are not sustainable and green buyers, there can be this turnoff of, 'Well, I don't want to pay

extra to be green,'" Guokas said. "But, the truth is, you can build a pretty normal house at a pretty reasonable price. What you're paying for is energy efficiency and comfort, which will save you money in the long run and make for a house that is more comfortable to live in."

To learn more about JAC's building and design process, visit jagreen.com.



A key component to the home is the south-facing wall, which is ideal for a passive solar design.



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Echo Hills Cottages is creating a sense of community through sustainability. ECHO HILLS COTTAGES PHOTOS

Bridging Sustainable and Social Gaps

Earth Care, Fair Share and People Care at Echo Hills Cottages

BY GARRET K. WOODWARD

When Ron Czecholinski and his wife moved to Asheville in 2010, he had one goal in mind: to create a sustainable development that truly focused on the meaning of the word “community.”

“Our intention has been to do this kind of development where we combine the pre-green building techniques and philosophies of the 1970s with a lot of work in community building,” said

Czecholinski, owner of Asheville-based Habitat Re-Imagined. “It’s a ‘co-housing light’ development as we say — smaller and less complicated than co-housing, but with similar goals of a strong sustainability focus in both environmental and social issues.”

There are 11 homes ultimately planned for the 3.25-acre West Asheville property known as Echo Hills Cottages. Czecholinski is already headlong into the project. The sixth house is currently under

“We’re designing each home to flow with the contours of the hills and keeping as much wooded area intact as possible.”

construction, while two more are in development.

“The standards and aesthetics are a similar look and feel, but every home is different and custom built,” Czecholinski said. “We’re designing each home to flow with the contours of the hills and keeping as much wooded area intact as possible.”

The ethos of Echo Hills Cottages encompasses three areas: earth care, fair share and people care. A core focus is to merge green initiatives with a keen sense of permaculture, and the landscape design includes water retention throughout the property; native, drought-resistant and edible plants; common park and garden areas; and organic and natural care, among other features.

Czecholinski designed one recent project, the home at 10 Well-spring Lane, to attain a gold certification through the Green Built Homes program, but with solar panels added, it pushed it to platinum certification. The home ulti-

mately achieved Platinum Net Zero Energy level certification through Green Built Homes.

“We’re designing the houses to be net-zero energy ready. Once you put the solar on, you become net-zero energy. And for most months, you’re only paying the standard monthly solar hookup fee to Duke Energy, which is about \$15,” Czecholinski said. “By establishing that pattern for a solar option early on in the building design and process, you’re creating a system integrated for the best results,



The solar orientation of the home ensures the structure can take full advantage of passive solar.

Project Team

- General Contractor** — Habitat Re-Imagined
- Construction Lead** — Greg Ward Construction
- HERS Rater** — EcoSense Design
- HVAC** — Sheer Comfort
- Electrical** — Bald Mountain Homes
- Plumbing** — Peace of Mind Plumbing
- Excavation** — Bearco
- Solar** — Asheville Solar Co.



The exterior finish of the home consists of Low-E windows, insulated fiberglass doors and stucco siding.

rather than just trying to add more of this and more of that to reach platinum.”

Beyond all of his sustainable initiatives and intentions, Czecholinski wants to stand out from other green developers and projects by purposely aiming to create a true sense of community

Echo Hills Standard Green Features

- Foundation is R-25 Insulated Concrete Forms (ICFs) for finished space.
- Walls above grade are R-27 Structural Insulated Panels (SIPs).
- Exterior finishes consist of Low-E windows, insulated fiberglass doors and stucco siding.
- Plumbing includes high-efficiency tankless or heat pump water heater, as well as dual-flush toilets.
- HVAC includes high-efficiency mini-split heat pump and Heat Recovery Ventilation (HRV).
- Insulation is a combination of urethane, expanded polystyrene (EPS), and open cell foam with weatherization detailed for optimal building performance.
- Interior finishes includes formaldehyde-free cabinets, and no- or low-VOC finishes.
- Solar orientation ensures that buildings can take full advantage of passive solar energy.
- Other custom green and sustainable features are available for each custom home.

through an underlying form of sociocracy that lies at the foundation of Echo Hills Cottages.

“To me, sustainability really has to go beyond the environment. It’s the concept of permaculture, and the integration of environmental, social and economic issues in sustainability. And we’re trying to do all of that,” Czecholinski said. “We want to build relationships with the people before we actually build the homes. We’re not building and selling to whoever comes, where there’s no plan for community. We’re looking for alignment and vision.”

Czecholinski pointed to storied architect Ross Chapin’s idea of “pocket neighborhoods” as a main inspiration for the property.

“Chapin took the co-housing concept from the 1980s and in the mid-1990s and converted it into a developer-driven model,” Czecholinski said. “And what’s so vital and needed in this movement is structure for the social component.”

Underneath that need for the social component, Czecholinski also noted three areas that must come together for the green foundation of each structure: energy efficiency, air quality and conserving materials.

“How we’re using energy, how we’re creating environments that are healthy for humans and animals, and how we’re not wasting materials is vitally important in our society,” Czecholinski said. “It’s crucial and critical that we start to address these issues in radical ways. We’re currently disconnected, digitalized and polarized. We need environments and structures that help us nurture a cooperative culture.”

To learn more about Echo Hills, visit echohillscottages.com.

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Regenerative Design

Green Built Homes Certification Evolves with Updated Checklist



The Green Built Homes certification system is evolving beyond its current approach of just rewarding features that make homes “less bad” for homeowners and the environment, to begin encouraging even more regenerative elements that actually improve the world around them.

JOE PELLEGRINO PHOTO

BY CARI BARCAS

Green Built Homes is updating its statewide certification program this year to incentivize builders to incorporate elements of regenerative design in their projects.

Formerly known as NC Healthy Built Homes, the Green Built Homes program has certified 1,700 houses by more than 250 builders across North Carolina since its inception in 2004.

As codes have changed and technologies have advanced in the 15 years since the program’s inception in 2004, Green Built Homes has continually evolved to encourage positive changes in the building industry and highlight new opportunities to make projects more sustainable.

Most recently, in 2015, the program added a Net Zero Ready and Net Zero Energy Certification to reward builders of homes that produce as much energy on site as they use over the course of a year.

Now in 2019, through the support of the Kendeda Fund and local partners, the Green Built Homes program is poised to take the next leap toward regenerative buildings. Regenerative buildings are designed and built so that they are integrated and have a net-positive impact on the natural environment around them.

“A basic study of sustainability and the built environment’s role in the climate crisis indicate that it is imperative to make every decision an environmental improve-

ment,” said Stephens Smith Farrell, an architect member of Green Built Alliance who also serves on the nonprofit’s Board of Directors. “Green Built Homes has shown that profound market change is possible. We’re going to continue pushing the margins of possibility until creating clean energy, cleaning the air and water, strengthening local economies, and ensuring the well being of all life with every action becomes standard practice.”

The certification system will evolve beyond its current approach of just rewarding features that make homes “less bad” for homeowners and the environment, to begin encouraging even more regenerative elements that actually improve the world around them. For example, a home with regenerative elements may produce more energy than it uses; capture and treat water onsite; incorporate biophilic design to enhance human connection with the natural world; or prioritize site restoration and native plantings or food production.

The program will now reward homes for calculating the total indoor and outdoor water use as designed. Homes that have the capacity to capture enough water to supply the needs of the home and manage 100 percent of their stormwater onsite can receive a new Net Zero Water Certification. Other expanded credit opportunities include use of completely non-toxic materials, onsite food production, restoring landscapes to protect local wildlife and more.

As part of the process, the Green Built Homes program will host a monthly series of in-depth, inspirational workshops through the fall and winter of 2019, which are aimed at educating and engaging building professionals in regenerative design.

“Many local builders and architects are ready for the challenge, inspiration and recognition of an advanced, regenerative version of Green Built Homes,” said Green Built Alliance Program Director Maggie Leslie, who manages the Green Built Homes program. “In addition, embedding items throughout the checklist will educate and inspire builders of all levels with new ideas.”

As Green Built Homes looks toward the next chapter of encouraging regenerative elements in its

projects, it is also celebrating the success of its Net Zero Certification. In four years since beginning to offer that, Green Built Alliance has certified 30 Net Zero Energy homes.

“The ultimate goal of this next step is a truly regenerative level of certification for homes that have a net-positive impact on the world around them,” Leslie said. “While this does not require new technology, it will take some time for building codes to adapt, so education and advocacy is a critical step to realizing our vision of a regenerative future.”

Cari Barcas is community engagement director at Green Built Alliance. She has more than a decade of experience in communications and nonprofit management, including time reporting on the green-building scene in Chicago as a journalist covering residential and commercial real estate. Connect with Cari at cari@greenbuilt.org.

Regenerative Design Workshop Series

In connection with the Green Built Homes program updates, Green Built Alliance will host a monthly series of in-depth, inspirational workshops through the fall and winter of 2019 with the intention of educating and engaging the community in regenerative design. Find a list of topics below, and more information and tickets at greenbuilt.org.

- Wednesday, Aug. 23 — Achieving Net-Zero Energy
- Friday, Sept. 6 — Buildings as Carbon Capture and Storage Devices
- Friday, Sept. 6 — Design Your Own Sustainable Home
- Saturday, Sept. 7 and Sunday, Sept. 8 — Essential Hempcrete Building
- Wednesday, Oct. 16 — Exploring Indoor Air Quality Through Whole Living
- Wednesday, Nov. 20 — Designing with Biophilia
- Wednesday, Dec. 4 — Energy Efficiency for Everyone
- Wednesday, Dec. 11 — Ecological Site Preparation and Long-Term Resilience

Midwifing Sustainability

Building and Selling Permaculture Incubators



Blueberry berms for rainwater retention are located below a high-performance house built as a permaculture incubator by Cardinal Point Construction, which attained Green Built Homes silver certification on the project.

DAN CLERE PHOTOS

BY DAN CLERE

How can a home be regenerative? What is it regenerating? And for whom?

These questions are great fodder for coffee conversation, and as green builders, we often take the basics for granted.

We want our homes to be durable and valued enough to provide shelter for several generations of people; we build them in such a way that we're not causing undue harm to our current ecology; and we design them to provide shelter that is exceedingly comfortable while it sips as little energy from the grid as possible.

These have been goals for years and we've come a long way in realizing them. These criteria ensure our projects remain relevant and valued, and are not a detriment to the earth. By using a combination of good craftsmanship, next-level design principles, and durable materials, we reduce the likelihood of unnecessary remodels or home

replacement.

In order for our homes to become regenerative, we have to take it a step further. Principles of permaculture allow us to do that. This is why we've begun building what we term "Permaculture Incubators."

For home construction, we consider the home in totality as one large system. In the case of a permaculture incubator, we expand that system to the out-of-doors to include the entirety of the lot it is sitting on and all of the forces that act on that lot.

The notion is that the home is the central locus of a living system that provides efficient and durable shelter for people, while the whole site provides a yield of food energy, peaceful respite, wildlife habitat, soil fertility, and rainwater retention and storage. The poetry of permaculture ensures that none of these activities occur in a vacuum, but instead reinforce each other in virtuous feedback loops

that make our landscapes whole.

Many of us have strived for years as weekend warriors to create permaculture landscapes around our homes. While invigorating and inspiring, it often hap-

pens in a haphazard way over a long period of time. My home is this way, along with those of many of my friends.

When we build an incubator, we're designing and building the entire property from the ground up to be loved on and lived in as a permaculture site.

By laying out the site with criteria such as sun angles, water flow, privacy, and wildlife habitat, we provide the building blocks of permaculture for the homeowner. We landscape with aesthetic woody perennials that provide food with minimal care so that occupants can simply graze across their outdoor space.

By installing fruit trees and other long-lived plants before the house is even occupied, we're providing the framework for a highly productive landscape. Establishing these fundamental aspects from the get-go presents buyers the option of plugging into a system they can nurture and reinvent to their

A Call to Collaboration From the Author

It occurs to me that much of our untreated wood waste would be terrific feedstock for a biochar retort. Imagine if we could convert the 2x material we normally send to the landfill into biochar for use onsite. I'm interested in building a retort large enough to swallow 105" studs, yet small enough to transport with a 10' trailer. If any welders, tinkerers, or biochar enthusiasts want to help build such a thing, please email danielclere@gmail.com.



A newly established kitchen herb garden sits below a screened porch at a house built as a permaculture incubator by Cardinal Point Construction, which attained Green Built Homes silver certification on the project.

hearts' content. The return on their investment becomes far more than simple equity on their mortgage.

In permaculture, the home is considered "Zone 0" in a series of zones radiating out from the house. The lower the zone number, the more frequently we visit that space. Most permaculture practitioners take "zone 0" for granted as an aspect of the design that can't be changed much.

As green builders, we're ensuring the home itself isn't a limiting

factor on the "home-place" by creating the most efficient and comfortable "zone 0" possible.

In this way, the site can rise above and give back more than it takes — maybe even regenerate.

Dan Clere is an Asheville-area green builder who owns Cardinal Point Construction (CPC) with his partner, Jodi Clere. CPC is currently beginning construction on a small neighborhood of permaculture incubators in the Haw Creek community of East Asheville.



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Incorporating Biophilic Design at Home

A bird feeder at a kitchen window allows intimate and unpredictable interaction with nature. MOUNTAIN SUN BUILDING & DESIGN PHOTOS

BY EMILY BOYD

We all know from experience that being immersed in nature makes us feel calmer, happier and rejuvenated. We seek a connection with nature, particularly when we are feeling stressed or sick.

It was only about 55 years ago that this innate desire to connect with nature and natural systems was given a name in the English language — biophilia — by social psychologist Eric Fromm. The term was later popularized by biologist Edward Wilson in the 1980s.

Since then, the benefits of con-

necting with nature in the built environment have been studied by specialists trying to increase productivity in the workplace, improve educational outcomes in schools and speed the rate of healing in healthcare settings.

The same biophilic design principles being studied and implemented in institutions can be applied to our homes where we spend the majority of our time so that we can see similar benefits in our personal productivity and well-being.

Here we'll look briefly at those biophilic design patterns that are easiest to implement in existing homes.

Bring light in

Ensure your home is filled with as much natural dynamic light as possible. Being exposed to the daylight as it moves and changes throughout the day not only increases connection to nature, but can improve sleep at night. Our circadian rhythms are controlled in large part by light cues. Keep blinds raised and interior doors open as much as possible to allow light (and air) to flow through your home from room to room.

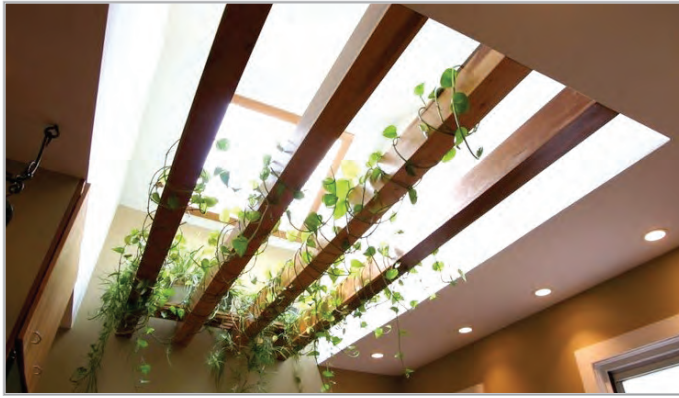
Encourage airflow

Temperature variation and fresh air in a home can be refreshing and invigorating and make the

home feel alive and part of the natural world, rather than separate from it. Open windows on opposite sides of the home to encourage cross breezes, and on upper and lower floors to encourage the stack effect.

If you must keep your windows closed, ceiling fans and freestanding or desktop fans are important for simulating natural breezes. Some fans now have a "natural breeze" mode which speeds up and slows down the fan's movement to imitate the feeling of a natural breeze. Even simulated nature has been shown to positively affect well-being.





A skylight brings southern light and opportunity for plants into an existing, previously dark kitchen.

Allow auditory connections

Allow the sounds of birds chirping, rain falling and leaves rustling in the breeze to come into your home by opening windows near where you spend time. If you are unable to open the windows in your home, playing nature sounds or using a small indoor waterfall can provide a similar effect.

Create visual connections

It is widely recognized that views are desirable features in our homes. You may not be able to create distant views where there are none, but being connected to nature on a more intimate level is important, as well.

To increase this connection, position landscape plants strategically to be seen through specific windows or to block non-natural views such as a neighbor's parking area or trash cans. Choose plants that provide shelter and food for birds to encourage them to frequent the viewshed of the window. Place indoor furniture so that there are views out windows from

seated positions as well as standing, and to ensure furnishings don't block any potential views.

Bring nature indoors

Indoor plants help to blur the lines between indoors and outdoors. Place shelves or plant stands under windows or add a plant shelf that crosses the window itself. Off-the-shelf products exist for growing plants vertically on a wall and can help bring nature to a windowless interior wall.

Consider adding windows or skylights to rooms that are occupied often but do not receive adequate daylight. It may only cost only a few thousand dollars, but drastically improve the quality of light and connection to nature. Get creative! Sometimes the most beautiful solutions arise from challenging situations.

Use natural materials

Choosing natural materials such as wood and stone for structure, finish materials and accents in our homes connects us both to



A living screen provides privacy and a sense of refuge while the open view offers a connection to the building's surroundings.

the natural world and to our geographic region, if we choose locally sourced products. The use of a natural color palette, particularly greens, has also been shown to be beneficial.

Create halfway spaces

Create a comfortable seating area in which to spend down time outside of the house. Semi-enclosed porches and outdoor rooms can provide a feeling of protection while allowing us to look out upon the natural world. These spaces encourage us to spend more time outside while at home and help to blur the divide between indoors and out.

Enliven your entry

Plant edibles, herbs and flowers along the path to the entry you and your guests use most to provide a multi-sensory natural experience as you transition between indoors and outdoors. Seeing the changes in what you have planted each time you pass deepens your connection to the plants, allows you to respond quicker to any problems that may arise and reminds you to harvest plants at their prime. Brushing up against a lavender bush or rubbing a leaf between your fingers as you

walk by can awaken your sense of smell and be invigorating.


Humankind has been building shelters that protect us from, but connect us to, nature for many thousands of years. Before that, we simply lived in the natural world.

Because humans have spent millions of years living in harmony with the natural world and a relatively short time in artificial indoor environments, biophilic design concepts can be easy to dismiss as intuitive and obvious. However, if we take the time to consciously recognize the patterns, we can consider how to fully utilize them in our everyday lives at home to reconnect with the natural world and help ourselves and our families to be happier, healthier and more productive.

Emily Boyd is co-founder of Mountain Sun Building & Design, a design-build firm focused on net-zero and green-certified homes. Having graduated from Appalachian State University in 2000 with a degree in construction and appropriate technology, Emily is a Certified Professional Building Designer and Certified Permaculture Designer. Connect with Emily at mountainsunbuilding.com.


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Amplifying Agrihoods

The Benefits of Neighborhoods Built Around Working Farms

BY ALLISON SMITH

Sometimes new problems call for old solutions.

That's the best lesson to be taken from the recent rise of housing developments built around working farms, also known as agrihoods.

Created to foster a sense of community and with a commitment to avoiding the environmental impact of conventional construction, these agrihoods are often on the cutting edge of green-building techniques. They also frequently employ sustainable technologies such as solar energy and geothermal heating and cooling.

But one of the most important factors contributing to the overall sustainability of these agrihoods isn't new technology at all, but rather the farms that exist at the heart of each development —

something that would have been perfectly familiar to our ancestors a century or even millennium ago.

Modern farming as we think of it, however, would not be perfectly familiar. In terms of sustainability, modern factory farming fails on all fronts.

Many of the common challenges present in modern farming — including soil erosion, water contamination, as well as dependence on synthetic fertilizers, pesticides and herbicides — are unintended consequences of the current prevalence of the monoculture approach that plants endless fields of one specific crop. This farming practice depletes the soil of nutrients, requires massive amounts of chemical fertilizers, and is generally all-around terrible for the earth.

Agrihood farms, by contrast, tend to focus on minimizing or completely eliminating such envi-

ronmental impact. Their *raison d'être* is the provision of fresh local produce to agrihood residents and the surrounding community. Their techniques are usually the exact opposite of factory farms and focus on applying older methods in a more modern way.

Where factory farms focus on monoculture, agrihood farms tend to grow a wide variety of local foods that change with the seasons. This is not only delicious but also an important factor in safeguarding the fertility of the land. By combining this technique with crop rotation and cover-cropping, agrihood farms are able to preserve the integrity of the soil and obviate the need for chemical fertilizers.

The environmental benefits of all of this can hardly be overstated. Avoiding the use of chemical pesticides and synthetic herbicides helps prevent contamination of

waterways and the produce itself, which is crucial for the health of the environment as well as the local population. It also protects the biodiversity of an area, allowing beneficial insects to flourish and local plants to thrive.

And of course, by offering a localized food source, agrihood farms avoid all the pollution inherent in the process of growing produce half a world away, then transporting it via ship and truck.

But there are other benefits to the local community as well — benefits our ancestors took largely for granted. They were accustomed to a more self-sufficient way of life, with towns able to supply their own food and residents able to enjoy all the health benefits of produce harvested at the height of its freshness. They were accustomed to a localized economy, with local businesses and all their neighbors benefitting from local labor.



Agrihood farms, like Olivette in Asheville, do something our ancestors took for granted, which seems almost revolutionary these days, by allowing residents to be nourished by food grown on the land they inhabit.
JOE PELLEGRINO PHOTOS

Olivette Riverside Community is being developed around a historic working farm.



These are the things that make agrihood farms not only environmentally sustainable, but communally sustainable as well. There is a vibrant farm-to-table movement spreading throughout the country, and a farm is necessary to get food to the table. By filling that gap and providing fresh, seasonal, organic food, agrihood farms ensure that local residents and businesses are the ones profiting from the locally grown produce.

Agrihood farms do something our ancestors took for granted, which seems almost revolutionary these days, by allowing residents to be nourished by food grown on the land they inhabit. They allow for a link between people and their land, as well as people and their neighbors — a link that is largely missing in modern life, and one that many people crave. It's not unusual for agrihoods to discover that their most popular parcels aren't the ones on the waterfront or with breathtaking views of mountains, but rather the ones near the farm.

The environmental issues occurring today are in many ways unprecedented, and innovations

such as green-building techniques and sustainable technologies play an important role in addressing those concerns. However, the rise of agrihoods has proven that sometimes the most progressive way to solve a problem is to avoid innovation.

Of course, the beauty of the concept is that it doesn't have to be one or the other. Agrihoods can utilize both cutting-edge green-building techniques and antiquated farming methods. They can offer modern amenities along with a distinctly old-fashioned sense of community. They can use that flexibility to provide a sustainable way of life and also profit as developments, offering examples to inspire others.

Allison Smith, a founding partner of Olivette Riverside Community and Farm and self-proclaimed foodie, draws her interest in farm-based communities from her passion to create a better world through sustainable living. She cultivates communities that foster social, emotional, educational, and cultural growth. Connect with Allison at olivettenc.com.



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This is a stormwater wetland that captures runoff from the school parking lot and nearby grassy areas. Here, stormwater runoff is detained, cooled, and absorbed by plants. This reduces pollutants in the runoff and cools it before reaching the Ivy River (located about 1,000 feet downstream of the school).
LAURA RUBY PHOTO

Is Wastewater Really a Waste?

Ecological Solutions for Treating Wastewater

BY LAURA RUBY

Water is one of our most precious resources.

It makes up more than half of the human body, 77 percent of our brains, and covers nearly 70 percent of our earth. Yet, less than 1 percent of the water on earth is drinkable.

With a shifting climate, the amount and distribution of precipitation is changing — and decreasing in many areas. As builders, designers and owners of homes and businesses, we have the opportunity to more fully integrate water into the spaces we interact with, while also cleaning this water before it cycles back into our waterways.

When we build a structure — including covered patios, driveways and roadways — we are reducing the amount of permeable surface on a site and thus increasing runoff. Further, anytime there is a disturbance of land and soil,

particularly during construction, there is the possibility for erosion and contamination of waterways.

When we combine machines used to move soil and other construction materials, there is the possibility for pollutants to be carried off site by stormwater. This article discusses the importance of safely filtering and sinking stormwater and other wastewater on site to reduce the negative impacts of sedimentation and pollutants in our waterways.

Working with water on site

The Living Building Challenge Water Petal envisions all future building sites to be net-zero water facilities. This means that all water needs, and subsequent wastewater treatment needs, are met on site. The site must also provide potable water from rainwater, include gray-water and black-water treatment, as well as offer stormwater management.

While current regulations and codes might limit some of the standards outlined in the Water Petal (specifically gray and black water), there are many strategies builders, designers and landowners can use today to get our buildings, and building sites, much closer to the net-zero water goals. We have the opportunity to repair land from construction damage while actually creating a landscape that is more regenerative and resilient than before construction began.

Oftentimes, water that falls in a landscape is piped, or directed, to leave a site quickly. This helps protect building foundations. However, once the water is moved a safe distance from a building's foundation, we can sink it, slow it and spread it into the landscape.

Soil, plants and mycelium work together to clean and infiltrate water before it leaves our site. They also have the ability to bring fertility and abundance back to a site through creating wildlife habitat, remediating pollutants, using their roots to hold soil in place, and providing an opportunity to grow edible and useful plants for wildlife and humans.

When talking about storing wa-

This is a straw-filled wattle inoculated with mycelium. It is used to reduce erosion and filter pollutants moving across a site. This is especially useful during, and just after, construction.

CHRIS GRABILL PHOTO

ter on site, many people think of installing rain barrels. Rain barrels are great, though many are small and cannot hold much roof water. Alternatively, one of the best places to store water is in the soil.

The current largest pollutant of the local French Broad River is sediment, and the EPA estimates that almost 70 percent of all water pollutants in our waterways are carried by rainwater runoff, according to groundwater.org.

Even if your site is clean, when water from your roof moves across other sites, roadways, etc, it picks up oil, chemicals, fertilizers, loose dirt, and more. If we sink more water in our landscapes, less will be available to pick up pollutants and sediment from neighboring sites.

Treatments and techniques

Fortunately, there are a number of techniques we can use to hold and filter water safely on site.

One technique for reducing the load on the stormwater system is through the creation of rain gardens. Rain gardens, or stormwater gardens, are a depression in the soil located on the downhill side of a lawn, roof, driveway or roadway. The soil in the depression is amended to improve permeability and then the area is planted with native plants.

Rainwater infiltrates through the area within 48 hours of a rain event. This prevents the opportunity of mosquito larvae to establish and keeps the area safe since it is free of standing water. Sediment and pollutants are absorbed in the depression as water slowly sinks in the soil and filters out. Some rain gardens, depending on the pollutant load, can include



mycoremediation techniques, as discussed below.

Vegetated bioswales are also effective at slowing the flow of water on a site and capturing sedimentation and pollutants. A swale is a trench, or depression, that runs along a site's contour, or slightly off contour. The soil from the trench creates a berm along the downhill side of the trench. This berm acts like a speed bump, slowing water from uphill.



This rain garden catches and cleans runoff from the roof and lawn before reaching the road and stormwater drain. CAPITAL REGION WATER DISTRICT PHOTO

Similar to a rain garden, water infiltrates the trench, recharging the groundwater as it slowly moves through. The swale is also vegetated and mycoremediation can enhance the treatment of pollutants. Vegetated swales are often used along roadways and parking areas. When they are designed to be slightly off contour, they can slowly direct water away from important infrastructure.

Another type of 'wastewater' that leaves a building site is gray water. Gray water is any domestic wastewater that is not sewage. This may include water from a kitchen or bathroom sink, a shower or bath, and from washing laundry.

Considerations that might affect your treatment design include how much gray water the building produces, as well as how you plan to use the gray water. There are examples of using bathroom sink water to fill your toilet basin to be used in the subsequent flush. Other systems use shower and laundry gray water to irrigate perennial plants.

In a simple system, gray water is directed to a gray water-specific pond that is planted with water-loving filtering plants such as cattails, water celery and yellow irises. There are abundant resources available online advising how to set up a gray-water system depending on the inputs and outputs of the system. Please note that gray-water systems are only permitted in North Carolina for spe-

cific purposes if it is treated according to code standards.

Mycolological magic

Plants, and their mycolological allies, have tremendous possibilities for stabilizing soil and removing possible pollutants from the site. When we say mycolological, we mean mushrooms!

The more remediating aspects of mushrooms exist in their underground parts, the mycelium.

The underground mycelia use enzymes to break down foreign substances, including the hydrocarbons in petroleum products and fuels.

Once you understand how water is moving through a site, you can place inoculated mulch basins that inter-

rupt the flow of water before it moves off site. These basins can be incorporated into rain gardens, vegetated bioswales and gray-water ponds.

A simpler, more temporary option that can be used during and just after construction is the use of wattles. These straw-filled tubes traditionally used to prevent erosion can be inoculated with oyster mushrooms where they slow and clean water as it moves across a disturbed area. They can be removed, or shifted, as other vegetated techniques are employed.

Other techniques worth consideration, depending on the size and location of your building and site, include: submerged, or sub-surface, gravel wetlands; stormwater wetland; biofiltration strips; and living, or green, roofs.

In our area, there are plenty of opportunities to include plants that help restore biodiversity, stabilize soil and provide food for people and wildlife. We can help sink, restore and clean site water by designing some of these techniques into our pre- and post-construction sites, and into existing landscapes.

Laura Ruby is the founder of Asheville-based YummyYards and a landscape designer with BareRoot Designs. We are committed to creating holistic spaces where all aspects of the landscape are used to benefit the system as a whole. Connect with Laura at yummyyards.com.

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Sustainable Academia

Appalachian State University Leads the Way

BY GARRET K. WOODWARD

Though Appalachian State University has always been at the forefront of sustainability, the academic institution took another step forward with its latest P3 project.

A public-private partnership (P3), the project will develop energy-efficient housing on its campus in Boone. The design is currently planned to replace seven residence halls at an estimated cost of \$191 million.

"This a large housing project which will be pursuing Green Built Homes certification," said Lee Ball, chief sustainability officer for App State. "As far as settling on the certification, we usually try to build to some form of certification. Our developer team actually decided to do Green Built Homes instead of the LEED green building program's certification."

Ball was pleased the developer team opted to work towards Green Built Homes, knowing well it would be a tougher road for such a massive construction project, but worth it in the long run.

"Green Built Homes is a little harder than LEED," Ball said. "The developer team made that commitment and that's great. They're



going through all the credits and conquering their learning curve with this first building currently under construction."

Since App State falls within the University of North Carolina System's 17 campuses, the school initially sought and received the blessing from the UNC Board of Governors to proceed with the project.

"At the end of the day, it comes down to policy and resources," Ball said. "And we will show the rest of the system that it's possible and has economic benefits as well."

The board's approval was a vote of confidence in a turning tide of interest in green building and sustainability at a commercial and academic level.

"I knew we couldn't greenwash this project as we went down this road," he said. "In terms of energy efficiency, we're at the very top. And with academics, we're also in the top. We've been number one before with our sustainability."

Since its inception in 1899, there's always been a component of sustainability at App State. It's a core principle at the school, which has evolved into numerous avenues of green initiatives — on campus and off.

"That's where we really shine, which is sustainability in the classroom — it's what we're really



Solar panels atop campus buildings are one of many green initiatives at Appalachian State. (top) University Solar Vehicle Team. (above) APPALACHIAN STATE UNIVERSITY PHOTOS



Aside from solar panels, App State also procures renewable energy from wind turbines on campus.

By the Numbers

- 77.24 points out of the possible 85 in STARS Gold Rating
- 41 percent of university waste was diverted from the landfill in 2017-2018 through reduction, recycling and composting
- 970 acres in deeded preservation
- 876 academic courses include some aspect of sustainability
- 26.86 percent of food purchased annually by university dining services comes from local producers, representing an investment of more than \$976,501 in the region's economy
- Ranked one of the "Coolest Schools" by Sierra Magazine

App State P3 Project Highlights

- Passive radon pipe mitigation system under the building slabs. Very few multifamily buildings do this, but more should. Radon is a fairly significant health concern and this system helps ensure that if radon levels exceed the EPA recommended limit at the end of the project, mitigation will be significantly simplified.
- Proximity to downtown. Between walkability, bus access and bike paths, the project gets several points by reducing the need to drive everywhere.
- Housing density. Because of the number of units on site, the project helps to reduce urban sprawl. Green Built certification rewards projects that are able to do this.
- Tree relocation. Several trees were actually moved from the job site and planted on adjacent property. This doesn't happen very often and is a great thing to do.
- Low-flow fixtures. These are used throughout the building on faucets, showerheads, toilets. This not only reduces total water usage, but, in turn, reduces hot water usage which saves a lot of energy in the buildings.
- Above-code insulation levels and window performance. This also helps with energy usage.
- Advanced framing techniques for wall framing. This reduces lumber usage and increases insulation levels.
- Close to 100 percent LED lighting in the buildings. This offers significant energy savings as compared to traditional incandescent lighting and reduces maintenance (changing bulbs).
- Steam. The building will be connected to the Appalachian State University Steam Plant via a newly installed steam and vault network along Jack Branch Drive. The plant steam will be used to generate hot water for the units and laundry.
- Fresh air ventilation system. One will be installed for each residential unit in the building.
- Third-party HERS rating for each building. This will be done by Matthew Vande of Vandemusser Design. Thorough construction inspections will occur after framing, insulation and after buildings are completed. Diagnostic testing will include blower-door testing on the thermal envelope, verification of equipment efficiencies, fan-flow testing, setting of fresh air ventilation, etc. A third set of eyes (after those of the general contractor and code inspectors) helps to ensure that everything will operate correctly after the buildings are complete.

Information provided by Matthew Vande of Vandemusser Design.

"We've stuck a flag in the ground as a sustainability school in the UNC system."

known for," Ball said. "We've had a composting program on campus for over 20 years and have solar panels on our roofs. We have a green fund where the students pay money to support renewable energy projects. Everywhere you turn there's something going on."

Each year, App State hosts the Appalachian Energy Summit, a gathering of UNC system schools and other regional institutions to discuss new and evolving green practices, all while comparing notes on where each is in their campus sustainability plans.

"The students come together in

Boone and share the best practices around for clean energy and energy efficiency — it's a pretty transformational event," Ball said. "Our goal right now is to save the UNC system \$2 billion by 2022 and \$5 billion by 2025. And we're on track [with over \$800 million saved already]."

Another side of sustainability App State is known for is its University Solar Vehicle team. The university-sponsored team has built two solar-powered cars that are tested and raced around the world.

"Sustainability is in our DNA," Ball said. "It's something that faculty and students have valued strongly, and it's bubbled up into leadership as well. We've stuck a flag in the ground as a sustainability school in the UNC system."

To learn more about the green initiatives at App State, visit sustain.appstate.edu.

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Planting for Future Generations

A Journey Toward Bioregional Food Resilience

BY DANU MACON

For millennia, the land we know as Western North Carolina has nourished and provided a home for thousands of species of animals, plants and fungi.

The web of life here in these mountains contains a grand diversity of stories, from the great towering tulip tree (*Liriodendron tulipifera*) to the majestic hellbender salamander (*Cryptobranchus alleganiensis*). There's an undoubtable magic that dwells in the wild lands of the Blue Ridge Mountains.

So, we as humans emerging from an unsustainable, industrial society are faced with a question. How can we approach living in this land in a regenerative way, that supports the flourishing of all the other unique life forms we share this home with?

The answers may come to those with persistent curiosity who ask at the right moment. Perhaps, the answers emerge at the beginning of a new homestead, or during an ecological summit, or right here in an article for you to read.

One answer to how our own human habitats can be rewoven into the fibers of natural ecosystems lies in how we procure our food. The land here is abundant and supports a great number of fruit and nut trees; this is an opportunity to more deeply connect with the cycles of harvest, storage and culinary relationship with the natural world.

Nothing tastes fresher than food from the very landscape we inhabit, and that has been a guiding force in my mission to bring edible landscaping to those who are either unaware of the nuances or unable to plant fruit and nut trees around their home landscape. I started a project called "1,000 Fruit Trees for Western NC," and have so far connected more than 500 fruit and nut trees to small-scale human homesteads in hopes of helping others begin and continue their path to bioregional food resilience.

Cultivated ecosystems have been providing food for humans



Cultivated ecosystems contain beauty in their diversity and support pollinators as well. DANU MACON PHOTOS

for thousands of years. Even before agriculture began some 5,000 to 10,000 years ago, human societies were managing forests to promote growth of abundant species of oaks (for acorns), other staple nut crops, and various fruiting trees that provided sustenance to a wide range of wildlife, including themselves.



Some permaculture-minded folks promote the notion that a cultivated ecosystem can produce significantly more calories per acre than a monoculture field based simply on the diversity of yield. Fruits come in a range of seasons and grow more vertically, providing space for many layers of harvest. From the ground to the very top of the tallest forest garden tree, plants are photosynthesizing and turning sunlight into food for the ecosystem to thrive.

With the predominant natural ecosystem of our area as hardwood forest, it only makes sense to mimic the pattern of how the world around us is growing to provide our sustenance. Planting fruit and nut trees is a gift to future generations and a way to live into the question mentioned before of how to support regenerative mutual flourishing.

So many mentors and inspira-

One of the many useful harvests from forest ecosystems is a wild chicken-of-the-woods fungi (*Laetiporus sulphureus*).

tions are hard at work in our bioregion helping to guide the way we look at food resiliency in the modern age. I encourage you as a reader of this article to continue the conversation with those who may otherwise not hear this perspective on ecological reintegration, and please plant a fruit tree or two. Or perhaps fill your yard or the yard of a friend.

From a small seed grows a great tree, feeding many generations to come.

Danu Macon plans to plant a million trees before his earth path carries through. He has studied permaculture and landscape design, including a year-long apprenticeship with local practitioner Zev Friedman.

Macon lives around Western North Carolina helping friends plant out their homesteads, leading efforts to bring fruit-tree education to public schools and telling stories of the regeneration of human ecosystems. Connect with Macon at wholotreepmaculture.tumblr.com.



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Whole Living

Completing the Green Experience

BY SEAN D. SULLIVAN

It's not hard to see why so many people have been bitten by the green bug.

Coast to coast, consumers are realizing that green homes can sell faster — and for more money — than non-green homes. And consumers have discovered that families living in green homes are often happier, healthier and more productive as well.

So you've bought a green home, but now what? As home-building professionals, we can take an active role in educating the consumer on what it means to live green beyond buying a green home and help our customers live whole-picture healthy lives.

What We Breathe

While a crucial component of being green is the sustainable use

of resources and having a low environmental impact, another piece of the puzzle is the impact installed products have on the health of the residents.

In a country where we statistically spend 90 percent of our time indoors, it's concerning that the EPA has found that indoor environments are typically two to five times more toxic than the outdoors.

So, what's causing this? One factor is the presence of volatile organic compounds (VOCs), which are commonly found in standard home-building materials, such as adhesives and finishes.

Another consideration is the airtightness of many new buildings. Older buildings often had plenty of natural ventilation and ample window area, which served to limit accumulation of air pollu-



Furnishing with natural fillers by Cisco Brothers

tants. Newer buildings, on the other hand, are more likely to be airtight, which can help to improve energy efficiency but can also create the conditions for higher levels of air pollutants, like VOCs.

Especially for new homes with tight envelopes and without fresh air ventilation, these toxic vapors remain in the home, are absorbed into furnishings and finishes, and can cause health problems over time.

Now that you know the problems, how can you help?

Consider the Contents

If we build a green home for our client, and then they fill it with furniture that is made with toxins, the wellness circle is detrimentally disrupted.

Furniture and furnishings are responsible for a large part of indoor pollution because they are frequently filled with added



Furnishings, casegoods and area rug made with natural products by Cisco Brothers.

In a country where we statistically spend 90 percent of our time indoors, it's concerning that the EPA has found that indoor environments are typically two to five times more toxic than the outdoors.

formaldehydes and other VOCs. Fabrics from upholstered goods are traditionally filled with chemicals to retard stains and flammability, while the frames and cushions are filled with glues, resins and other off-gassing finishes. This applies to all types of furnishings from upholstered items, to casegoods, and even area rugs.

Instead, look for brands that are flame retardant-free and fully recyclable, and those that use water-based adhesives and finishes. Seek out quality furnishings that are smart, healthy and responsible by choosing companies that use solid and Forest Stewardship Council-certified wood, certified organic textiles, natural latex, jute, hemp, wool, goose feathers and down. In addition to offering comfort and durability, these products can be inherently flame retardant without the use of chemicals.

In the event that a person is allergic to any of these natural materials, or a byproduct thereof (like dust mites who love down), there are some conscientious manufacturers that offer certified non-toxic and synthetic alternatives.

Living green post-purchase

There are also some misconceptions about the meaning of building and living green.

One of the biggest relates to the word "natural." Many believe that this word suggests a product

is safe to use or eat, but this isn't always the case. For example, radon, lead and mold are all naturally occurring but highly toxic.

Another misconception is the belief that if a home is built in a healthy way, then a healthy environment is ensured. While a built-green home with adequate fresh air ventilation helps at the onset, it's up to the homeowner to maintain a clean and green home that is healthy and well-maintained for its occupants.

Maintaining the long-term health of the building long after it is finished is hugely important to having a healthy home. This means implementing suggested behavioral strategies such as using non-toxic cleaners, locking up chemicals, cleaning vents and ductwork regularly, removing shoes and doing a deep clean twice a year.

Armed with these tools, it's possible to not just build, but live green.

Sean D. Sullivan is an Accredited Master Builder and the president of Living Stone Design+Build. He was selected as the Certified Green Professional of the Year in 2016.

Sean and his wife, Laura K. Sullivan of ID.ology Interiors & Design, have combined their passion for quality and green living by launching a retail store featuring healthy furnishings.

Connect with Sean at livingstoneconstruction.com.

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Staying on Course

Blue Horizons Project's Impact on Community-Wide Energy Efficiency

BY CARI BARCAS

In a single year since its launch, the local Blue Horizons Project energy-efficiency campaign has improved the lives of hundreds of area residents by helping to make their homes more affordable, durable and healthy.

These efforts go hand in hand with the Blue Horizons Project's goals of reducing the area's peak energy demand and creating the region's clean-energy future. The Blue Horizons project was launched in the spring of 2018 as the brainchild of the Energy Innovation Task Force community collaborative.

In collaboration with other local organizations, the efforts of the Blue Horizons Project and its Energy Savers Network program have measurably increased quality of life and decreased monthly energy bills for the homes of more than 300 low-income families in Buncombe County.

Operating under the umbrella of the Blue Horizons Project, Energy Savers Network helps people and the climate by working with volunteers to serve community members with the most need and



As a program of the Blue Horizons Project, Energy Savers Network helps people and the climate through working with volunteers to serve community members with the most need and least access to energy efficiency.

ENERGY SAVERS NETWORK PHOTOS

least access to energy efficiency. The program helps connect low-income families with a variety of available services to offer extensive energy-efficiency upgrades to their homes.

"While the program also seeks to educate families on free and affordable ways to reduce their home's heating expense, meaningful efficiency improvements can require substantial expense that families struggle to afford while they are facing high heating bills," explains Program Manager Jonathan Gach. "The program gets to help income-qualified families with a variety of improvements ranging from new energy-efficient light bulbs to insulation and air sealing, and even new heating and

cooling systems. Receiving these services can improve a family's quality of life for years to come."

Blue Horizons Project collaborates closely with other organizations including Mountain Housing Opportunities' Emergency Home Repair Program, Community Action Opportunities' Weatherization Assistance Program, Eblen Charities' Heating Assistance Program and Duke Energy's Helping Home Fund to have the maximum beneficial impact on as many local homes as possible. Income-qualified families receiving support are identified primarily through referrals by local nonprofits as well as area churches.

Gach said many clients need support performing relatively inexpensive repairs and simple maintenance, which can significantly improve their ability to keep their home warm and reduce their energy usage.

"Without the means to make the repairs themselves, many families turn to relying on expensive electric space heaters to keep warm," Gach says. "These inefficient electric space heaters, which are basically oversized hair dryers, can quickly push power bills into the hundreds of dollars. This common scenario becomes a financial trap for so many people in our community."

In another pivotal early success, the Blue Horizons Project has also been credited with playing a key role in influencing Duke Energy's decision to take off the table plans to build a natural gas peaker plant—one of the core concerns that prompted the formation of the Energy Innovation Task Force in early 2016.

In postponing construction plans for a natural gas peaker plant from 2023 to 2027, Duke attributed that decision in late 2017 to



Energy Savers Network was presented with the Energy Innovator Award by the Energy Innovation Task Force.

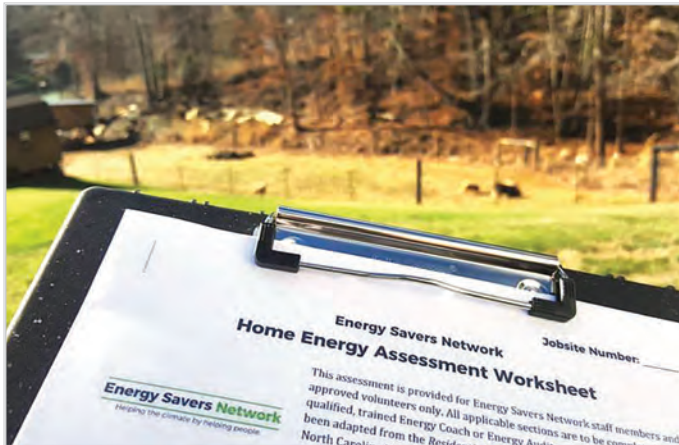
the success of the Energy Innovation Task Force, whose work laid the groundwork for the Blue Horizons Project. Since the launch of the Blue Horizons Project, Duke took it a step further and removed the peaker plant from its plans completely in its latest filing with state regulators.

Energy Savers Network continues to hold ambitious goals for the future, with plans to serve another 100 or more clients by the end of 2019. It will continue to grow its collaboration with partner pro-

grams and improving its ability to bring community resources for health and safety needs closer to home for local families in need.

Cari Barcas is community engagement director at Green Built Alliance. She has more than a decade of experience in communications and nonprofit management, including time reporting on the green-building scene in Chicago as a journalist covering residential and commercial real estate. Connect with Cari at cari@greenbuilt.org.

Energy Savers Network is under the umbrella of the Blue Horizons Project, which is a community campaign to help everyone lower their energy use.



Introduction to Blue Horizons Project

The Blue Horizons Project is designed to make a clean energy future a reality in Buncombe County by improving access to and engagement in the wide variety of energy efficiency programs and resources available to local residents and businesses. Through a suite of strategic energy efficiency and demand-response solutions, Blue Horizons Project aims to serve as a comprehensive hub of programs to empower community members to save money and reduce the area's peak energy demand.

The initiative was informed by the work of the region's Energy Innovation Task Force, which convened in 2016 with a diverse cross section of representatives from the city, county, Duke Energy Progress, regional nonprofits and the local business community, along with

environmental and clean-energy advocates. The EITF spent two years gathering data and developing strategies before launching Blue Horizons Project in March 2018 to carry forward its goals of transitioning the region to a clean energy future and averting the need for Duke's to build a new natural gas plant in the coming years that would serve only to meet rare occasions of peak demand. The Blue Horizons Project is funded through collaborative contributions from Buncombe County, City of Asheville, Duke Energy and a Southeast Sustainability Directors Network grant.

To learn more about Blue Horizons Project and the various energy-efficiency programs available to the community, visit bluehorizonsproject.com, and follow the project on Facebook and Instagram. For questions about how the program can help your home or business, email sophie@bluehorizonsproject.com.



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Taking the Plunge

Preparing A Home for Electric Cars

While electric-vehicle charging can be added to existing homes, those who are still in the planning stages of building a new home definitely have the advantage of implementing this more easily and affordably. VANDEMUSSEER DESIGN PHOTOS



BY AMY MUSSER AND MATTHEW VANDE

We recently took the plunge to buy a plug-in hybrid electric car, and wanted to share some things we've learned from our experience to help people in Western North Carolina plan for future plug-in cars.

Our driveway sits about 75 feet

away from our house and once we coordinated someone to dig the trench and a licensed electrician to run the electrical line out to the driveway, we were able to decide on the level 2 car charger we wanted to use.

There are several excellent chargers on the market, but the one we chose had a 40A charging option (faster rate of charging),

multiple charging schedules (which we needed for our time-of-use electric rates), connected to our wireless network, and allowed us to monitor and control the charger via a phone app.

The charger allows us to fully charge the car battery in less than two and a half hours — much less than the 8 hours it used to take with the 110-volt charger which

plugged into a standard outlet.

To determine how much electricity you are likely to use, you need to know how many miles your car travels per charge, and how many miles you typically drive in a day. If you are getting a plug-in hybrid that can operate on gas sometimes, you will likely use some gas on long trips but mostly use electricity when you're driving

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Electricity needs are determined by the number of miles the car travels per charge and distance typically driven in a day.

around home.

If you have active photovoltaic (PV) panels or plan to incorporate solar in the future, it's a good idea to estimate how much electricity the car will use, and make sure you either install enough panels to cover the car's usage, or confirm that the system you do install is capable of easily adding enough solar for a car in the future. You would need to talk to your solar installer about choosing an inverter large enough to handle the additional solar, using microinverters, or having a combi-electric meter for the home that will allow solar to feed directly into the meter, bypassing the home's electric panel.

Before the electric car, our house was essentially operating at close to net-zero energy. The car definitely increases our usage, and we will need to account for this with additional PV panels to get back to net-zero status.

A rule of thumb previously used by the Green Built Homes program is that 2kW of additional south-facing solar PV capacity is needed to charge a car. The following example calculation shows how you can customize this for your own situation.

A typical small electric car gets about three miles per kWh. One car company estimates the average driver uses about 2,520 kWh per year, which would be an average of 20 miles per day (or 7,308 miles per year) of electric driving. Meanwhile, a 1kW south-facing solar panel in Asheville with no shading and typical mounting angles and inverter efficiencies will produce about 1,400 kWh per year.

So if you take our typical electric car driver with 2,520 kWh per year in electricity consumption and divide that by the 1,400 kWh per year produced locally for each kW of installed PV, we get 1.8kW

of additional PV capacity needed.

If you drive more, are buying a car with a longer battery range, or need a larger vehicle that gets fewer miles per kWh, you may require more solar. And if you drive less, you may not need as much.

We built our house in 2011. Back then, no one was planning for electric cars.

That is definitely changing, though. Many of the builders we work with now run a 240-volt line to the parking area so adding a car charger is simply plug-and-play. It's by far the cheapest time to do this work.

If we could go back in time, we would have run the 240-volt line out to the driveway when everything was still exposed and we knew where the utilities were laid. Waiting to do this work until 2019 meant we had to pull an electrical permit with the city, hand dig the trench out to the driveway so we didn't damage any utilities, and repair pathways and landscaping when it was all complete.

What would have cost a couple hundred dollars back when the house was being constructed easily ended up costing more than \$1,500 by waiting until the house was finished. It was definitely still worth it for us, but those who are still in the planning stages of building their new home definitely have the advantage of working this into their construction schedule.

Amy Musser and Matthew Vande are the owners of VandeMusser Design, PLLC. They provide Home Energy Rating (HERS) services, green design consultation, and home energy audits to homeowners in Western North Carolina. Amy is a licensed mechanical engineer and Matt is a licensed architect. Connect with Amy and Matt at vandemusser.com.

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Demystifying Crawl Spaces

Crawl Space Choices in Southern Appalachia



Encapsulated crawl space.
HARPER ROBINSON PHOTO

BY SARA SABOL
AND MARCUS RENNER

If you are confused about the best method to control moisture and humidity in your crawl space, you are not alone.

We recently visited Marcus' 84-year-old independent father, Helmut. It quickly became apparent that there was a substantial mold issue in his home, as his baseboards and back bedroom closets had some decent growth.

A trip to his crawl space unveiled the obvious culprit: not only had he blocked off his vents with fiberglass insulation, he had a decent plumbing leak. His home is only 12 years old.

A pair of curious neighbors came over to see what was up. Helmut told them that we were discussing options for controlling the humidity, since he had sealed off his crawl space vents. The neighbors made eye contact with us.

"Helmut, those vents are designed to open and close with the seasons; they are not meant to be sealed shut," they offered. We

nodded in agreement. Helmut replied, "Oh, no, not anymore, the new code says that you are supposed to seal the vents permanently." We shook our heads, signaling to the neighbors that they should not heed his advice.

By the way, Helmut was a mechanical engineer for 40 years and his son owns a company that encapsulates crawl spaces — i.e. he is someone with knowledge and resources that could have helped him make a better decision. But he had read somewhere that code now requires that the vents are sealed, and so crawled down there one day to do the job, unbeknownst to us.

The takeaway of this story is that a lot of people are confused about their crawl spaces and misinformation is easily passed along that can lead to damage to a home.

So, crawl spaces are confusing and some of them have frustrating mold and moisture issues. Also, some of them are haunted. OK, we are kidding on that last part (actually, no, we're not).

The good news is that there are ways to control and eliminate moisture problems, so the space is less problematic. (Note: if your crawl space is haunted, don't call us.)

Whether you do the work yourself or hire a professional, here are some notes to consider, so that results do not do more harm than good.

Crawl spaces generally fall into two categories: vented and unvented.

Vented crawl spaces — the traditional method — use foundation vents to allow moisture to escape the crawl space. The foundation vents should be opened in the summer and closed in the winter. The current building code allows this method of crawl space as long as there is a vapor barrier, which is just thin plastic on the floor. Oftentimes, homeowners in this climate discover that this method is not effective in eliminating humidity issues and can actually make the humidity worse. Studies have shown that open vents in the summer allow more moisture in then out due to high humidity in the Southeast region. Humidity can lead to mold, other fungi, wood decay and poor indoor air quality. (And ghosts ... just kidding.)

Unvented crawl spaces are often called "conditioned," "sealed," or "encapsulated" crawl spaces. We like to use "encapsulated" because we think it has the nicest ring to it. The current building code also allows for this second variation of the crawl space. This method eliminates or blocks foundation vents; blocks out ground moisture with a heavy-duty, thick, plastic, sealed membrane; and incorporates a way to dry the air with either a dehumidifier or an HVAC supply vent or indoor air supply. A professional-grade dehumidifier is most commonly used. The building-performance industry has determined that this is the best method to address a new or existing crawl space in our region.

We've really got you on the edge of your seat right now, eh?

So, back to Helmut. He only sealed his vents, which trapped moisture in the crawl space. He did not control the ground moisture or condition the air with a dehumidifier, so he was on the right track to an encapsulated crawl space but missing two very important parts.

Learn More

For even more exciting information that helps break down this confusing topic, visit crawlspaces.org

There are many ways to encapsulate a crawl space and many companies that do it. The basic tenants are: stop outdoor air from entering the crawl space; install a strong, sealed, vapor retardant membrane on the floor, walls and support piers of the interior of the crawl space; and condition the air so that it is dry enough to not support mold or fungal growth. There are lots of YouTube videos that will give you a good visual idea of what the finished product will look like.

There are a couple of final tidbits to consider.

If your only issue is humidity, an encapsulation will do the trick. However, if there is standing water in your crawl space, you will need to take further measures to address this. Make sure that your gutters are not overflowing and are diverted away from your house. Still have water intrusion? Is the slope around your home directing water toward the foundation? If so, exterior landscape grading may be needed. Darn, there is still standing water? As the final touch, you may need to install a sump pump that collects any excess water and pumps it outside.

It's also important to note that once you have encapsulated, you can't just close the door and forget about it. Routine maintenance is a must to make sure the dehumidifier, monitoring equipment, and sump pump are functioning properly, and that the sealed membrane is intact.

Oh, and don't worry about Helmut. The plumbing leak is fixed, and we have since encapsulated his crawl space, properly sealed his vents and installed a dehumidifier down there to control the humidity and prevent mold.

Sara Sabol and Marcus Renner own Conservation Pros, an energy-efficiency retrofitting firm in Asheville. They have been encapsulating crawl spaces and improving the efficiency of homes and businesses since 2007. Connect with Sara and Marcus at conservationpros.com.

Radon in Our Mountain Homes

Detection and Correction Is Worth the Price



Ethan Rossler and Rick Bayless place a radon sample strip in an Arden family home that is under contract for sale. SCOTT J. PARKER PHOTO

BY RICK BAYLESS

When you buy a new house, is radon on your radar? In Western North Carolina, the answer should be yes.

Radon is an odorless, colorless radioactive gas which arises from uranium and thorium deposits in soil throughout the geology of the mountainous region we call the Southern Appalachians. Put simply, naturally occurring uranium, deep in the bedrock, decays in stages and gives off the gas and/or irradiated particles that we call radon.

Radon is in the air, which also means it can exist between soil particles, within rock, or within the groundwater. In extremely low levels, such as in marble or granite countertops, it's not problematic.

But in excess, and particularly when inhaled into the lungs, it can become deadly. The microscopic, radioactive particles get trapped,

and when they release small bursts of energy into lung tissue, the risk of lung cancer rises exponentially.

Scientists at the National Institute of Health estimate that about 20,000 lung cancer deaths annually may be attributed to radon. The consensus suggests there is no safe level of radon in one's home, due to its cumulative effect over time. In any event, a measured radon level of 4.0 picocuries or greater indicates that the home's inhabitants are at significant health risks from radon exposure.

In Western North Carolina and across the mountains of the southern Appalachians, home buyers and owners should insist on radon tests. This entire region is in a "red zone," or high-incidence area at risk for radon. Federal mapping of reported radon measurements shows that Buncombe and Henderson counties are in a zone that's particularly conducive to high lev-

els of naturally occurring radon.

Micro-zones of local radon incidence also exist throughout the entire southern Appalachian region including Western North Carolina, upstate South Carolina, Eastern Tennessee, and North Georgia. These micro-zones can result in varied radon results even between neighboring houses, and given the swath of radon that runs underneath the region's topography, all homeowners need to test to be on the safe side.

Radon testing is currently optional in North Carolina, though this may change in the future. The Department of Health in the county of your new residence or the county home inspector will be able to definitively answer your questions about state or town laws. The EPA also has a set of solid guidelines to follow for those who choose to test for radon, regardless of whether it is legally required.

The good news is that radon testing is both inexpensive and something most homeowners can do themselves at a cost of less than \$20 for one sample that's hung for three to seven days. It is most important to sample the lower parts of the home where you spend the most time such as the basement family room, or the crawl space from which your air system draws. In real estate dealings, everyone involved should insist on a qualified, licensed radon professional.

The downside for do-it-yourselfers is that one radon test won't adequately assess radon risks. It is better to test a range of samples over time and conditions, pulled from areas such as the crawl space, particularly at times when the house is warmer than the outside air.

To understand how radon works, you'll want to think about the way your house breathes.

The house exhales warmer air due to the “stack effect.” Hot air rises through the ceiling and finds ways to escape outside. Mechanical devices may also drive the breathing of the house. When turned on, these devices move air through the air pathways. Radon levels are highest when the stack effect is greatest.

ent for each home, but homeowners can begin by caulking and sealing cracks in slab floors or foundations to block places where radon enters the structure. Attention should be placed on any unsealed or uncapped holes in the slab flooring or below-grade walls; plumbing, gas or electric lines; or tiny faults in construction.

Radon-reduction systems can make a dramatic difference. Suction under the slab or under the plastic in the crawl space may be needed to exhaust the air under the slab so no radon particulates can be drawn in. In other cases, ventilation may be used to bring in fresher outdoor air and dilute low-level radon situations in the home. Lastly, net-positive air pressure may be used to blow air into the house, pushing radon out. Whatever the case, levels can be reduced by as much as 99 percent overall, increasing the healthiness of your home.

Though these types of measures sound costly, they're not out of reach. Of course, the larger and more complex the house and its systems, the greater the number of possible interventions

needed and the higher the potential cost. Still, most radon remediation jobs average in the \$1,500 to \$2,500 range. That's less than the costs associated with moving, and it protects home and personal health, so it's worth doing.

Rick Bayless is an award-winning, National Environmental Health Association-certified home consultant and author of "Mold in the Southern Appalachians: Identifying, Preventing and Managing Mold Issues and Mold Related Illness." He is the owner and founder of A Healthier Home LLC, Western North Carolina's leading environmental home health services provider. Connect with Rick at ahealthierhomenc.com.



Cracks in the foundation may look innocuous, but they provide a path into the structure for deadly radon gas.
RICK BAYLESS PHOTO

Useful Radon Resources

- The EPA Map of Radon Zones — epa.gov/radon
- The North Carolina Radon Program (DHHS) — ncradon.org
- Buying Guide for the Best Radon Detectors — passtools.com/buying-guide-best-radon-detectors

Now, let's consider the inhale side of your home. When a barrel full of air leaves the home, the same volume must be pulled in. Radon, when occurring, is pulled in with the home's inhale.

So where does radon originate? The biggest culprits may be found in below-grade foundation walls. Cracks in the foundation or wall, coupled with contact with soil that has a high radon content, forms a primary pathway through which radon can seep into one's home. Exposed soil under a slab or crawl space can also prove problematic. As the suction of the home's exhale pulls air into the structure, radon particles now have a clear pathway into the house.

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The local Appalachian Offsets program provides individuals a way to offset their carbon footprint by paying into a fund that completes energy efficiency upgrades and renewable energy projects at Western North Carolina schools and nonprofits. People can use the carbon calculator on the website, cutmycarbon.org, to calculate their footprint and a suggested annual offset amount. Users then can contribute any amount of offset in one annual lump sum or divided into monthly installments. PAT BARCAS PHOTO

The Value of Carbon Offsets

Testimonial from a Former Skeptic

BY CHRISSY BURTON

The term “carbon offset” is unfortunate. It is so literal but still somewhat figurative. What exactly is a carbon offset? It begins by calculating my personal carbon footprint. How much carbon is produced every year in

support of my lifestyle — carbon from electricity, carbon from miles driven, carbon from my diet? The amount of carbon is measured in metric tons and the average American produces 20 metric tons of carbon per year.

A carbon offsetting program

sets a price per metric ton, and a person offsets their carbon footprint by purchasing as many tons as their lifestyle produces. The funds are then invested in projects, technology, and research to remove carbon from the atmosphere. Carbon is removed by reducing community power usage, generating electricity from a renewable source, or funding plantings that sequester carbon.

My experience

In the past, I have been skeptical of carbon offsets.

I was clueless as to what purpose they serve, and suspicious of people choosing to purchase an abstract idea of carbon reduction over making lifestyle changes. I did

not understand how carbon offsetting could be anything less than a salve for consumerist guilt.

Flash forward to present day, and I am a monthly carbon offset subscriber through the local Appalachian Offsets program administered by Green Built Alliance.

I have learned that carbon offsetting is an investment in sustainable projects. I made lifestyle changes, and now I make an even bigger impact by contributing to carbon reduction in my community.

I do have some consumerist guilt, but carbon offsets are not my comfort. Carbon offsets allow me to be part of a solution that is larger than my individual choices or purchases. It is a means to combine my investment with other environmentally-minded citizens to complete a project that will remove more tons of carbon from the atmosphere each year than any single choice I make in my lifestyle.

Furthermore, those projects will remove carbon for years to come. Carbon offsets have a more lasting impact.

Our choices

Lifestyle changes can reduce my carbon footprint.

If I ate meat with every meal but switched to a completely vegetarian diet, I would reduce my carbon footprint from 3 tons to 1.5 tons per year. If I purchased a carbon offset in the amount of that difference, those funds would be used to install solar panels, LED light bulbs, or other sustainable technologies that would remove 1.5 tons of carbon from the atmosphere every year for many years.

The carbon offset builds on my individual efforts.

There are some lifestyle choices I have control over and some I cannot change. For instance, I live and work in cities focused on car travel and ownership. I may drive fewer miles, carpool, or take public transit, but I am still producing carbon. I will never reduce my usage to zero tons of car-

Offset Options for All

As outlined in the article, Appalachian Offsets offers individuals the ability to simply offset their carbon footprint either with an annual lump sum or divided into more manageable recurring monthly payments.

But did you know that Appalachian Offsets has an option for businesses too? Businesses can opt to offset the footprint of their entire operation or a portion.

Visit our website to learn about your footprint and offset options through our individual and business carbon calculators.

Thanks to our generous supporters including AB Tech, Delttec Homes, Deutsch & Gottschalk Attorneys at Law, Joel Adams and Associates Investor Advisors, LaZoom, Mosaic Realty, Samsel Architects, SouthWings, Trillium Family Medicine, and Vandemusser Design for offsetting their footprints through Appalachian Offsets.

bon unless the entire network of transportation is switched from fossil fuels.

I don't have the power to change systems on that scale as an individual, but I can combine my investment with a group of like-minded people to fund a project that will start that process. The carbon offset accomplishes a reduction I cannot meet as an individual.

Simple lifestyle changes can have a big impact if everyone makes the same choices. However, it's not reasonable to expect everyone to adopt the same lifestyle choices I make for myself. Besides, I might drastically reduce my carbon footprint in one area of my life but I can't seem to make the same reduction in other areas.

The carbon offset balances those areas where I'm doing well with the areas where I could stand to improve.

Our efforts, multiplied

I have come to love the idea of carbon offsets. I cannot imagine a better or easier way to make a lasting impact in my community.

I love knowing that my carbon-reduction efforts are multiplied. I

feel good about combining my investment with others to make reductions I could not achieve on my own. I am reassured that even if I can't live the perfect zero-carbon lifestyle, I'm still helping move my community towards a cleaner, more sustainable future.

And I achieve all that with a small monthly payment. I can offset my entire carbon footprint or just my flights, miles driven, omnivore diet, etc. I can set a small recurring donation that will make a big impact when it's combined with other carbon-offset funds.

I am always striving to reduce my carbon footprint through my personal choices, but no matter how successful my individual efforts are, I am funding long-lasting, impactful projects within my community that will hopefully bring about the sustainable future I am envisioning.

Carbon offsetting is convenient, it is effective, and it is one of the small ways I make big changes for a more sustainable future.

Chrissy Burton is an architect and LEED AP BD+C practicing in Asheville, NC. She is the current chair of the Board of Directors for Green Built Alliance.

Isaac Dickson Elementary School.



Our Latest Projects and What's Next

In 2019, Appalachian Offsets officially completed fundraising for its largest and most ambitious project to date with the goal of installing a solar system on Isaac Dickson Elementary School in Asheville.

The fundraising process was not without its challenges, but we are delighted to report that the solar panels are scheduled to be installed within a year, most likely when school is out for summer break. More specifics on timing and the size of the system will be available in the fall of 2019.

Stay tuned as we look forward to announcing our next community project in 2020.

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Small-Scale Residential Housing

Infill Housing, ADUs and Tiny Homes

BY JOE ARCHIBALD

Often when people think about sustainable building, they think about material sourcing, location of the building on the property, renewable energy sources and the other more common metrics.

Just as important a factor, however, is where the building is located within the community.

When it comes to housing, especially here in the mountains around Asheville, finding suitable building lots is getting harder.

Many builders and clients have realized that building smaller, utilizing infill lots and developing within existing neighborhoods is a great way to not only weave into that community, but to also reduce the need for car trips, lessen the creep of suburban sprawl and bring more vitality to areas that have been previously neglected.

Also, as more people live alone, remain single longer or choose to not have children, smaller-scale housing is becoming a more popular option.

Let's take a quick look at some recent initiatives that the City of Asheville has worked on in an effort to promote small-scale residential development to create a denser and more vibrant urban core.

Infill housing

Infill housing, in its simplest terms, is filling in the gaps between existing buildings.

In city planning terms, it refers to the rededication of open land to new construction, typically within urban areas. Sometimes these open spaces were previously built upon but have gone vacant over time. More commonly new buildable areas are created through the reallocation of property boundaries, such as when an owner decides to subdivide their property to create two or more parcels where there was previously only one.

Many of Asheville's suburban developments of the early 1900s had lots that were in excess of an acre in size and, over time, as the city has grown outward, these developments are no longer subur-



Generally considered to be dwelling units of less than 300 square feet, most tiny homes are built off-site and meant to be mobile. NANOSTEAD PHOTOS

ban but are now considered a part of the urban environment. (Think about Kenilworth and Lake Shore Park as examples.)

In an effort to create more available land for housing development the City of Asheville's Urban Planning Department in 2017 passed new zoning regulations to the Unified Development Ordinance (UDO) that allow for reduced lot parcel sizes when an owner decides to subdivide their property.

Allowable lot widths were decreased, along with reductions to overall lot square footage. Depending on where the existing building is located on the lot, these reductions may be even more. Off-street parking requirements still remain, however there are some adjustments, again depending on the existing lot conditions.

ADUs

Accessory Dwelling Units, or ADUs, are housing units that are either part of the main residence on the property (known as attached units, basement or attic apartments) or a separate building that is smaller in size and scale to the main building (known as detached units).

Detached units are the type often associated with ADUs; garage

apartments or granny flats are typical names for these units. All ADUs are required to have a separate electrical service meter, and detached units often require separate water and sewer connections.

These last two items can make ADUs less affordable to build than clients desire. Even with their limited size (800 square feet is the current maximum), they truly are another house with regards to their construction and utilities required.

In an effort to promote this type of development, Asheville's Urban Planning Department passed new regulations governing the size and location on both attached and detached ADUs.

"To address the lack of housing, in 2015 we decided to update standards for ADUs to make them easier to build and to allow for more housing to be distributed throughout the city in backyards," said Vadilla Satvika, an urban planner with the City of Asheville, regarding the new regulations that were approved in 2016. "We realized ... that a key challenge to allowing them was that current standards (at the time) only allowed ADUs on conforming lots. ... Effectively 20 percent of properties were prohibited from ADUs just because their lot was not meeting standards, maybe having the lot

frontage too narrow or a garage that could be converted to an ADU was encroaching into a setback. So we moved ADUs from the UDO article that requires lots to be conforming and into another place. Now, all residential parcels can build ADUs."

This change has led to an increase in the number of ADUs being built, however there remain challenges in the process which have slowed progress toward the city's initial estimates of the number of units that would be created.

The biggest of these challenges is cost; an owner either needs to have cash in hand or the ability to obtain a home-improvement or other loan on the existing building in order to have the funds to construct the ADU. Bankers report it is quite difficult to obtain a mortgage directly on a detached ADU, which hinders the ability for many to construct them, even if they have the space and desire.

Tiny homes

Another potential option for increased housing options and density within existing residential areas can be found in tiny homes.

Generally considered to be dwelling units of less than 300 square feet, most tiny homes are built off-site and meant to be mo-

This 12-by-26-foot accessory dwelling unit was completed by Nanostead in the spring of 2019.



bile. Most, however, are never moved, despite being installed on temporary foundations.

While there are a few tiny home communities that have developed in the greater Asheville area in recent years, they have not become a significant component of small-scale residential infill development.

Challenges to their increased prevalence include cost and the availability of utility connections, along with regulations restricting

the use of trailers (recreational camper trailers) as long-term housing. (Currently, the use of RV trailers parked for housing in a city residential area is not allowed for long-term use. While tiny homes aren't typically considered an RV trailer, that is the closest similar structure type.)

The City of Asheville has not created any significant regulations directly pertaining to tiny homes to date, nor have state or national building codes. There are discus-

sions regarding tiny homes within many building code development committees, and there might be specific building codes adopted in the coming years.

Societal challenges

As with any new development, infill housing, ADUs and tiny homes have their detractors.

Despite the generic opposition to increased density, the primary argument against these forms of small-scale residential housing relates to the lack or age of public utility infrastructure. These concerns typically revolve around water and sewer line capacity.

While it is a fact that some areas of the city have infrastructure issues and that replacement of existing utilities is much more difficult than building new infrastructure in a suburban area, it is also true that developing new housing within existing neighborhoods and urban cores has a far lower life-cycle impact than any 'green' suburban development.

Another infrastructure issue is stormwater capacity. Properly designed and built infill development should not contribute negatively to stormwater impacts, especially

when compared to the impact of new highways or large scale suburban retail development, something that more dense urban neighborhoods offer as contrast.

The takeaway

If you are a green builder, developer or client who is looking for a new avenue to reduce the impact on the land in our community, give some thought to creating small-scale housing options.

Not only are they a current growing trend, they truly are one of the best sustainable housing options that can be made.

Joe is the owner of Narwhal Design/Build, PLLC, a craft-based design and fabrication firm specializing in small-scale residential and renovation design work and custom woodworking. He is a licensed architect in North Carolina, Maryland and Washington D.C., who serves on the City of Asheville's Planning and Zoning Commission. He lives above friends in a 1900s duplex in a moderately dense North Asheville neighborhood. Connect with Joe at narwhalbuilt.com.

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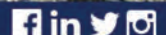
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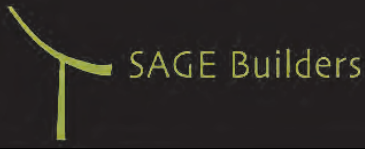
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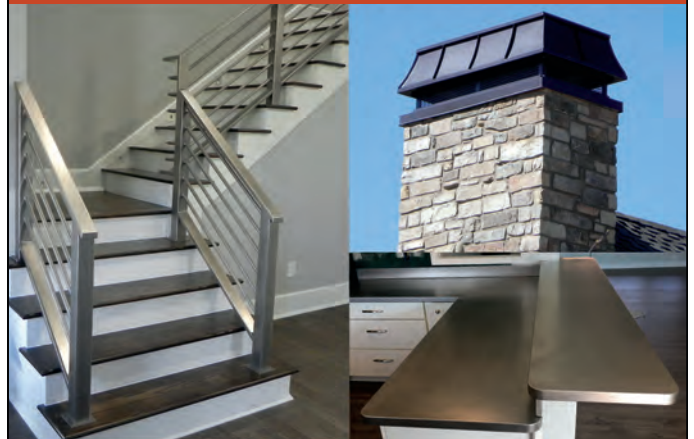
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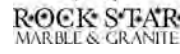
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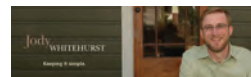


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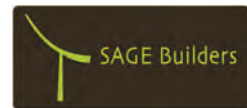
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thetwinbrothercorporation.com
We are a family business of general contractors that specialize in commercial remodels and home building.

Thermal Wall Technologies
Mike Sandefur
Evansville, IN • 812.449.5695
m.sandefur@wowway.com
3rdmillenniumproject.org



Timberframe Horizons, LLC
Tom Rouse
Fairview • 828.222.2555
tom@timberframehorizons.com
timberframehorizons.com
We are a design build firm that specializes in creating energy-efficient custom artisan homes utilizing timber frame construction.

Appraisers



JW Appraisal Services LLC
Janice Whitson Waycaster
Marion • 828.925.8157
jwappraisalservices@gmail.com

Architects

ACM Design PA
Amy Conner-Murphy
Asheville • 828.684.9884
margaret@acmdesign.net
acmdesignarchitects.com



Alice Dodson Architect, PA
Alice Dodson
Weaverville • 828.645.9326
alice@alicedodsonarchitect.com
alicedodsonarchitect.com
Integrated and affordable residential architectural design, long-time experience with alternative energy use and various energy-efficient, high-performing construction.



BCA, PLLC
Brent Campbell
Asheville • 703.969.6804
nicole@bcavl.com
bcavl.com

Carleton Collins Architecture
Carleton Collins
Asheville • 828.285.0430
ccollins@carletoncollins.com
carletoncollins.com

GLAZER ARCHITECTURE

Glazer Architecture
Patti Glazer
Asheville • 828.254.5853
pg@glazerarchitecture.com
glazerarchitecture.com



GRIFFIN ARCHITECTS, P.A.

Griffin Architects PA
Robert Griffin
Asheville • 828.274.5979
inquiries@griffinarchitectspa.com
griffinarchitectspa.com
Griffin Architects provide years of experience and interpretations of specific information relative to the clients needs, the site and its orientation, and the neighborhood's relationship to the community. We offer 3-D Energy Modeling/Virtual imaging services of custom residential designs and additions, commercial developments, environmental design, community planning, and historic preservation.

Haizlip Studio, PLLC
Reb Haizlip, FAIA
Asheville • 828.252.1600
reb@haizlipstudio.com
haizlipstudio.com
Haizlip Studio specializes in planning, exhibition and architectural design for family learning environments and attractions.

Kenneth J. Wertheim, AIA, Architect
Ken Wertheim
Asheville • 828.298.7280
k.wertheim@att.net
mntnarc.com



Legerton Architecture, PA
John Legerton
Asheville • 828.251.9125
john@legertonarchitecture.com
legertonarchitecture.com

"Let our buildings celebrate our relationship with nature and protect the clean air, the clean water and the clean soil."

—David Suzuki, Trim Tab interview, Spring 2013



Mathews Architecture, P.A.

Jane Mathews
Asheville • 828.253.4300
firm@mathewsarchitecture.com
mathewsarchitecture.com
Jane Mathews leads a firm of LEED Accredited Professionals, offering design solutions for residential, commercial, governmental, and nonprofit buildings across the Southeast. The first NC Healthy Built Homes Program pilot project and Asheville's LEED Platinum Dr. Wesley Grant Sr. Southside Center are two in a wide spectrum of sustainable projects.



Narwhal Design Build, PLLC

Joe Archibald
Asheville • 828.273.9509
joe@narwhalbuilt.com
narwhalbuilt.com
Craft-based design & fabrication firm providing architectural design and custom woodworking, utilizing environmentally preferred products and guide by social consciousness.

PETER TART ARCHITECT

Peter Tart Architect

Peter Tart
Asheville • 828.412.1289
peter@peterart.com
peterart.com
To understand the client's needs and desires the Architect uses critical questioning and listening skills and has found that problem-solving is most successful when communication is open, comprehensive and thoughtful. This foundation helps to achieve a result unique to the needs of the clients, site, and budgeting leading to a successful project that will sustain delight for years to come.



PFA Architects, PA
Maggie Carnevale
Asheville • 828.254.1963
mcarnevale@pfarchitects.com
pfarchitects.com

Platt Architecture, PA

Alfred Platt
Brevard • 828.884.2393
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Asheville • 828.253.1124
info@samselarchitects.com
samselarchitects.com
Samsel Architects was founded in 1985 with a strong sense of stewardship for the environment and our community.

Stephens Smith Farrell Architecture

Stephens Farrell
Asheville • 828.231.4915
ssf@ashevillearchitect.com
ashevillearchitect.com
This LEED-accredited practice celebrates the joy of design and building with owners and developers of sustainable commercial and residential projects.

Virant Design Inc.

Tom Virant
Asheville • 828.231.0092
info@virantdesign.com
virantdesign.com



What on Earth Architecture

Jonathan Lucas
Asheville • 828.236.2947
jonathan@whatoneartharchitecture.com
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Delightful, green architectural design through a fun collaborative process. Flexible, affordable services. 3D computer visualization & solar analysis. Over 27 years experience. LEED AP



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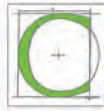
Calder Wilson
Asheville • 828.257.4930
calder@w2arch.com
w2arch.com

Artisans & Metalwork



Johnson Hilliard Metalwork
Ben Ripley
Kingsport, TN • 423.247.4176
ben@johnsonhilliard.com
johnsonhilliard.com

Attorneys



Capua Law Firm
Christa Capua
Asheville • 828.264.0260
christa@capualaw.com
capualaw.com

Ward and Smith, P.A.

Sara Oglesby
Asheville • 828.348.6070
sno@wardandsmith.com
wardandsmith.com
We ensure your legal matters are handled with attentive intelligence by attorneys and staff collaborating to build meaningful relationships with clients. We do this by being knowledgeable in more than 30 practice areas, providing efficient results, and effectively using technology. Our core values are client satisfaction, reliability, responsiveness, and teamwork.

Bldg Performance Contractor



Conservation Pros

Sara Sabol
Asheville • 828.713.3346
sara@conservationpros.com
conservationpros.com
Conservation Pros is a building performance contracting firm providing solutions to energy efficiency, inadequate insulation, crawl space mold and moisture, and indoor air quality in homes and business across WNC.

Builders



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Jeremy Bonner
Asheville • 828.258.2000
jeremybonner@a-b-construction.com
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Altitude Builders Inc

Jason Waldrup
Fletcher • 828.273.8192
jasonwaldrup@gmail.com
abiasheville.com

Amarx Construction, LLC

Kyle Gilliland
Asheville • 828.775.4001
kyle@amarx.net
amarx.net

SHARE AND BORROW ITEMS with neighbors and friends that are occasionally used for yard work and home maintenance as opposed to buying new equipment.



Balsam Homes, LLC

Brunilda Weber
Asheville • 828.338.9576
bweber@balsamhomesllc.com
balsamhomesllc.com
At Balsam Homes, we are working diligently to provide elevated green living to the beautiful mountains of Western North Carolina. Sustainability is at the core of everything we do. Combined with our passion for design and attention to detail, we craft exceptional homes that delight. We love what we do.



Beach Hensley Homes

Beach Hensley
Asheville • 828.782.3342
beach@beachhensleyhomes.com
beachhensleyhomes.com
Beach Hensley Homes provides sensibly crafted, fixed-priced homes that are affordable, responsibly built designs with a focus on efficiency and urban infill building. To us, it's bigger than home building - we want to foster the growth of the community while simultaneously preserving the integrity of our Appalachian ecology.

Beech Cove Builders LLC

John Hupertz
Leicester • 828.215.7778
jhupes@gmail.com



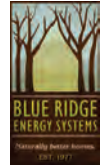
Bellwether Design-Build

Brad Rice
Asheville • 828.225.5990
brad@bellwetherbuilders.com
bellwetherbuilders.com



Best Built Inc.

Adrienne Buck
Clyde • 828.280.0415
bestbuiltinc@outlook.com
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Veteran green building contractor located in Haywood County. Design-built custom homes tailored to fit your lot or one of ours. Lots or Home/Land packages available.



Blue Ridge Energy Systems

Jamie Shelton
Fletcher • 828.775.8665
info@blueridgeenergysystems.com
blueridgeenergysystems.com
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Bostic Builders

Mike Bostic
Fairview • 828.606.6122
mikebosticbuilders@gmail.com

Brock Builders, Inc.

Chris Brock
Asheville • 828.243.6105
chris@brockbuildersinc.com
brockbuildersinc.com

Brown Wulff Homes

Josh Brown
Asheville • 828.337.5034
joshmarcbrown@gmail.com
brownwulffhomes.com



Buchanan Construction, LLC

Rick Buchanan
Asheville • 828.650.6565
rick@buchananconstruction.com
buchananconstruction.com
A green home is healthier to live in and healthier for our planet. It is our mission to build green homes that bring together the features of an environmentally-friendly structure, while maintaining the function and design of a custom built, up-scale home - our unique hybrid of green and luxury.



Builtwright Construction Co.

Andrew Gardner
Asheville • 828.545.0052
info@builtwright-construction.com
builtwright-construction.com

Camptown Construction

Frank Prince
Brevard • 828.884.5452
camptownconstruction@icloud.com
camptownbuilders.com



Cardinal Point Construction, Inc.
Dan Clere
Asheville • 828.712.5424
danielclere@gmail.com



Continuous Improvement Construction LLC
Duane Honeycutt
Black Mountain • 828.551.7573
ciclcl.duane@gmail.com
cic-llc.squarespace.com



Corner Rock Building Co.
Zachariah Banks
Weaverville • 828.252.7787
zach@cornerrockbuilding.com
cornerrockbuilding.com
We are a one-of-a-kind custom home building company, who specializes in green, energy efficient, and sustainable construction. Our purpose is to give you an uncommon home building experience; one as beautiful and as comfortable as the homes we build.

D.A. Fiore Construction Services
Kyle Fiore
Swannanoa • 828.768.8404
pinnaclelandscapemgmt@gmail.com

DeBord Enterprises, LLC
Donald DeBord
Asheville • 828.974.1700
donald.debord@gmail.com

Deltac Building Company
Cindy Criss
Asheville • 828.257.4907
ccriss@DeltacHomes.com
deltachomes.com



Duinkerken Homes, Inc.
Brandon Duinkerken
Alexander • 828.450.9395
duinkerkenhomes@gmail.com
duinkerkenhomes.com



Earthtone Builders
Greg McCuffey
Asheville • 828.230.4469
earthtonebuilders@gmail.com
earthtonebuilders.com
We are a leading green building company committed to the highest standards in construction quality and sustainable, healthy living.



Equinox Woodworks
Todd Kindberg
Burnsville • 828.284.6552
todd@equinoxwoodworks.com
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Darren Henegar
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Evergreen Construct specializes in custom-built homes and renovations, using your inspiration to create mindfully crafted structures through a collaborative process.



Falcon Construction and Development
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tanya@falconbuilt.com
falconbuilt.com
Residential and Commercial construction services. 2012 Parade of Homes Best in Show winner. Specializing in quality green construction and design build of both new homes and remodels of existing



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Jim Forward
Asheville • 828.298.9532
JTFBuilder@gmail.com
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Going Green Builders LLC
Ryan Jacques
Brevard • 828.577.3472
goinggreenbuilders@gmail.com
goinggreenbuilders.info

Grace Builders
Brad Hutchinson
Fletcher • 828.676.1888
brad@gracebuilderswnc.com
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With quality as our foundation and a drive for excellence in performance, Grace Builders seeks to be the best choice for building your dreams. Our passion is to cultivate community through our residential and commercial construction services with intention, focusing on the ultimate goal of sustainability.



Grammatico Signature Homes
Brooke Geiger
Biltmore Lake • 734.945.1565
grammaticohomes@gmail.com
grammaticohomes.com
Grammatico Signature Homes is an Asheville-based full-service building company offering complete home building, remodeling, consulting, and real estate.



Green Earth Developments
James Boren
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Our business involves developing responsible homes on a site where the trees are considered very important assets to this planet. Love your new green home!



Green Light Home Builders LLC
Jon Sloop
Asheville • 828.450.2484
jon@greenlightcustomhomes.com
greenlightcustomhomes.com

Greencraft, Inc.
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ashevillegreencraft.com
We are committed to serving Asheville as a sustainable builder. Our focus is super energy-efficient, high-quality and environmentally sound home-building.



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Boone • 828.264.8971
tomo@highcountrytimberframe.com
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Holbrook & Nichols Construction
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Lake Toxaway • 828.966.4400
john@holbrook-nichols.com
holbrook-nichols.com



HomeSource Real Estate & Construction, Inc.
Tim Alexander
Asheville • 828.252.1022
tim@homesourcebuilders.com
homesourcebuilders.com
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Jade Mountain Builders & Co. Inc
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Jade Mountain Builders is a team of 31 craftsmen who pride themselves on taking an ecologically sensitive approach to building homes.



JAG & Assoc. Construction, Inc.
Jody Guokas
Asheville • 828.216.0914
jody@jaggreen.com
jaggreen.com
JAG Construction is a small company specializing in in-town urban spec construction. Our goal is to make healthy, creative, long-lasting houses more available to the general public. We're examining new ways to reduce the impact of construction on the environment around us and preparing for a future of alternative energy.

JSS Homes, LLC
Dan Arrowood
Candler • 828.215.9622
arrowood197@bellsouth.net
jsshomesllc.com



Judd Builders
John Judd
Arden • 828.274.4448
parkerv@juddbuilders.net
juddbuilders.net
In 2007, John Judd Sr. and John Judd Jr. formed Judd Builders with a vision to build quality custom homes with sustainable and environmentally friendly materials and building practices. We look at each home like it has its own ecosystem and adjust our green-building approach accordingly to match clients' needs.

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jlandry@khbuilt.com
khbuilt.com

Kogi Group LLC
Alfonso Socarras
Arden • 828.775.5901
alfonsosocarras@hotmail.com



Living Stone Design+Build
Molly Sullivan Reeves
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Black Mountain • 828.669.4343
molly@livingstoneconstruction.com
livingstoneconstruction.com
Living Stone Design+Build crafts award-winning custom homes that exceed clients' expectations. For over 20 years, our proven process and strategic partnerships with architects, designers and realtors has delivered dream-worthy homes at the best value to hundreds of families and couples seeking a happier, healthier life in the mountains.

Longview Builders
Kevin Hackett
Asheville • 828.423.8902
Kevin@longviewbuildersinc.com
longviewbuildersinc.com
We focus on a team approach with owner, designer and builder to deliver award-winning green homes on time and budget.

LMT Homes
Lauren Tamayo
Asheville • 828.318.3740
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lmthomes.com
LMT Homes is a modern builder taking a unique approach. Our form and design follow the functionality in a home.

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Matt Kern
Asheville • 828.231.1252
cazkern@aol.com

McCourry Construction Inc
Brandon McCourry
Burnsville • 828.208.0959
mccourryconstructioninc@hotmail.com
mccourryconstruction.org

BIOPHILIA: The innate, genetically determined affiliation of human beings to nature and other living organisms. (definition from the LFI LBC Healthy and Happiness Guidebook)

McHugh Designs

Bobby McHugh
Asheville • 828.712.8451
rebaloo@bellsouth.net
mchugh-designs.com
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Jesse Meinch
Swannanoa • 828.243.2997
jesse@meinchconstruction.com
meinchconstruction.com

Mike Eubank Construction, Inc.

Mike Eubank
Enka • 828.667.0513
mikeeubank@att.net

Milestone Contracting

Dustin Penland
Fairview • 828.342.8211
dustin@milestonebuilding.com
milestonecontracting.net

Milo General Contractor, LLC

Andy Stowe
Asheville • 828.702.2735
andy@milogeneralcontractor.com
milogeneralcontractor.com



Mountain Sun Building & Design

Emily Boyd
Asheville • 828.713.0549
emily@mountainsunbuilding.com
mountainsunbuilding.com
As both a land developer and a design/build firm, we can help clients at any stage of the new home building process. We focus on site-specific design and Zero Energy Homes, creating finely crafted, light-filled interiors that capture the beauty of and connect to their natural surroundings.



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Chris Nemec
Swannanoa • 828.216.1717
chrismemec@gmail.com
nemecconstruction.com

New Pointe Builders

Jim Ayers
Hendersonville • 828.329.8024
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Nicholson and Sun LLC

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Old North State Building Company

James Dose
Black Mountain • 828.623.0009
office@onsbc.net
oldnorthstatebuildingcompany.com

Osada Construction

Matt Osada
Asheville • 828.505.1605
info@osadaconstruction.com
osadaconstruction.com

PebbleDash Builders

Brian Hutzler
Enka • 828.215.3905
bhutzler@pebbledashbuilders.com
pebbledashbuilders.com



Pioneer Construction and Development Inc.

Duane Liming
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With over 25 years of experience, Pioneer consistently blends innovative ideas with time honored quality. We work until your project or new home is true to your vision. To learn more call us at 828.768.8771



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rareearthbldrs@bellsouth.net
rareearthbuilders.com
We build high-performing, exceptionally beautiful custom homes while minimizing negative environmental impacts with attention to construction details and client comfort.



RCJ Building Inc.

Robert Jacobelly
Asheville • 828.216.4433
rcjbuilding@yahoo.com
rcjbuilding.net
RCJ Building Inc.'s custom homebuilding professionals have the knowledge and expertise that you'll need when you have the opportunity to build the house you've always wanted. We understand what goes into the building process, and more importantly, what goes through the minds of future homeowners during the build.



Red Tree Builders, Inc

Brandon Bryant
Asheville • 828.712.1518
Brandon@redtreebuilders.com
redtreebuilders.com
At Red Tree Builders, we strive to ensure that each of our clients receives a home that is as masterfully crafted as it is mindful. To us, this means tending to our clients' needs as well as respecting the land on which the home is built.

Robert Roepnack

Robert Roepnack
Asheville • 828.545.5363
Bob@roepnack.com
jcrdesigns.net

RS Motley Construction

Rob Motley
Asheville • 828.776.7470
rsmotleyconstruction@gmail.com
robmotleybuilder.com
We distinguish ourselves through communication, honesty, transparency, attention to detail, and building each home as if it were our own.



Sage Builders

Doug Keefer
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info@thesagebuilders.com
thesagebuilders.com
SAGE uses Sustainable, Appropriate, Green and Efficient building techniques to create beautifully hand-crafted homes with passive and active solar amenities.

Schumacher Homes

of North Carolina
Eric Anderson
Asheville • 828.490.4805
erwilhelm@schumacherhomes.com
schumacherhomes.com/states/north-carolina

Scroggs Construction Services LLC

Nicholas Scroggs
Swannanoa • 828.552.3222
nick@scroggsconstruction.com
scroggsconstruction.com



Sineath Construction

Company
Allyson Sineath
Weaverville • 828.645.8518
asineath@sineathconstruction.com
sineathconstruction.com
We're committed to offering you a place constructed with care; using quality, sustainable materials with enduring value and timeless appeal.

RAIN GARDENS are an inexpensive way to capture stormwater runoff and avoid flooding in your home and yard that conserves and recharges groundwater.



Solid Rock Builders LLC

Travis Meinch
Weaverville • 828.712.3280
travis@solidrockbuilders.com
solidrockbuilders.com
We focus on providing our customers with a wonderful building experience, and a beautiful efficient custom home.

Standing Stone Builders, Inc.

David Ulrichs
Asheville • 828.713.2771
daveulrichs@gmail.com
standingstonebuilders.com



Steel Root Builders

Bob Koplos
Asheville • 830.832.7610
bob@steelrootbuilders.com
steelrootbuilders.com
We specialize in modern luxury homes, complete renovations and commercial upfits.



Stewart Builders Inc.

Mary Stewart
Canton • 828.421.1939
marestew@gmail.com
stewartbuilders.net



SULASKI & COMPANY

Sulaski & Co.

Robert Sulaski
Asheville • 828.273.4458
robert@sulaskico.com
sulaskico.com
We are a builder and developer of well-planned homes and communities.

Sundog Homes

Joel Sowers
Asheville • 828.774.5720
info@sundoghomes.com
sundoghomes.com
Sundog Homes is a division of Sundog Development Company LLC, an unlimited general contractor with projects in NC and SC.



Sure Foot Builders Inc.

Raymond Thompson
Asheville • 828.242.0925
surefootbuilders@gmail.com
surefootbuilders.com
We are a green home building company working in the greater Asheville area. It is our passion to build beautiful and creative homes that add value and comfort to the lives of our owners and community. In each home we strive to articulate modern green building practices.

The Brigman Group

Tim Brigman
Weaverville • 828.273.1185
timbrigman@gmail.com
thebrigmangroup.com

The William Baxter Co.

William Baxter
Almond • 828.506.8759
thewmbaxterco@aol.com

Thompson Properties, Inc.

John Thompson
Fletcher • 828.684.7750
Info@ThompsonPropertiesInc.com
thompsonpropertiesinc.com



Timberframe Horizons, LLC

Tom Rouse
Fairview • 828.222.2555
Tom@TimberFrameHorizons.com
timberframehorizons.com
We are a design build firm that specializes in creating energy-efficient custom artisan homes utilizing timber frame construction.



Timberline Custom Homes, LLC

Mark Montini
Asheville • 828.628.6800
timberlinehomes@att.net
timberlinecustoms.com

Town Mountain Builders LLC

Kirk Johnson
Asheville • 828.231.7379
townmountainbuilders@gmail.com
townmountainbuilders.com



Tyner Construction

Marc Tyner
Burnsville • 828.682.7421
marc@tynerconstruction.com
tynerconstruction.com

Wells Construction Group

David Wells
Asheville • 828.712.2669
dfwells@bellsouth.net



Wheelhouse
Chris Faulkner
Brevard • 828.577.5493
chris@wheelhousebuilders.com
wheelhousebuilders.com

Workman Enterprises
Eric Workman
Asheville • 970.355.0731
ericworkman@gmail.com



WSM Craft
Smith McAulay
Asheville • 828.337.1957
smcaulay@wsmcraft.com
wsmcraft.com

Cleaning

Clean Environments
Nina Young
Asheville • 828.239.0040
nina@cleanasheville.com
cleanasheville.com

Commercial Builders



Buchanan Construction, LLC
Rick Buchanan
Asheville • 828.650.6565
rick@buchananconstruction.com
buchananconstruction.com

A green home is healthier to live in and healthier for our planet. It is our mission to build green homes that bring together the features of an environmentally-friendly structure, while maintaining the function and design of a custom built, upscale home - our unique hybrid of green and luxury.



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John Judd
Arden • 828.274.4448
parkerv@juddbuilders.net
juddbuilders.net

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Mary O'Connor
Asheville • 415.609.9213
oconnmar@gmail.com
epicmindconsulting.com

Crawlspace Sealing



Conservation Pros

Sara Sabol
Asheville • 828.713.3346
sara@conservationpros.com
conservationpros.com

A building performance contracting firm providing solutions to energy efficiency, inadequate insulation, crawlspace mold and moisture, and indoor air quality in homes and business across WNC.

Developers & Communities

Asheville Housing Authority

David Nash
Asheville • 828.258.1222
dnash@haca.org
haca.org

Building for Life, L.L.C.

Stuart Zitin
Asheville • 828.230.1424
stuartzitin@charter.net
buildingforlifeasheville.com
We have completed many renovations, additions, and a few new homes in Asheville since 1996. Now we have begun developing 4 south-facing acres in Oakley, a mile from Biltmore Village. Homes are Energy Star/Green Built Certified—some with mountain views and some affordable, including a Cottage Development.

East West Capital Group

Brian Nelson
Asheville • 828.490.1156
bnelson@eastwestcapitalgroup.com
eastwestcapitalgroup.com

A real-estate private-equity investment firm with a focus on acquiring, repositioning and managing value-add projects. We focus on driving successful residential and commercial projects in urban areas and in the path of development. Sources of capital include the principals and funding from Asia and the U.S.



Green Earth Developments

James Boren
Asheville • 386.690.0886
JamesBoren@yahoo.com
loveyournewgreenhome.com
Our business involves developing responsible homes on a site where the trees are considered very important assets to this planet. Love your new green home!

Habitat Re-imagined

Ron Czecholinski
Asheville • 828.407.9989
ron.czecholinski@gmail.com
habitatreimagined.com



Hickory Nut Forest Eco Community

Jane Lawson
Gerton • 828.625.4780
laughingwaterscontact@gmail.com
hickorynutforest.com

Hickory Nut Forest Eco-Community in Gerton, 17 miles from Asheville, sits on over 100 acres with waterfalls, wildflowers, and mountain vistas. The community includes 20 home sites with green, solar homes surrounded by forever-wild land, organic orchard/gardens, hiking trails, and Laughing Waters Retreat Center, which utilizes hydropower generated from Hickory Nut Creek.



JAG & Assoc. Construction, Inc.

Jody Guokas
Asheville • 828.216.0914
jody@jaggreen.com
jaggreen.com

JAG Construction is a small company specializing in in-town urban spec construction. Our goal is to make healthy, creative, long-lasting houses more available to the general public. We're examining new ways to reduce the impact of construction on the environment around us and preparing for a future of alternative energy.

Mountain Meadows on

Crooked Creek
Bernie Byrne
Mars Hill • 828.230.0755
bernie@ashevillmountainlots.com
ashevillmountainmeadows.com

APPALACHIAN OFFSETS is a voluntary carbon-offset program from Green Built Alliance that offers businesses, organizations, and individuals the option to easily reduce or offset their carbon footprint. Supporters offset their emissions by paying into a community fund that helps make energy-efficiency improvements within local nonprofits, schools and low-income housing. Learn more and donate at cutmycarbon.org.



MOUNTAIN SUN BUILDING & DESIGN

Mountain Sun

Building & Design
Emily Boyd
Asheville • 828.713.0549
emily@mountainsunbuilding.com
mountainsunbuilding.com

As both a land developer and a design/build firm, we can help clients at any stage of the new home building process. We focus on site-specific design and Zero Energy Homes, creating finely crafted, light-filled interiors that capture the beauty of and connect to their natural surroundings.



Olivette Riverside Community and Farm

Allison Smith
Asheville • 828.407.0040
info@olivettenc.com
olivettenc.com

Olivette is a 346-acre planned community and historic farm on the French Broad River, just 6.7 miles from downtown Asheville. The agrihood community provides seven acres of riverfront beach, a private river island, miles of walking trails, and community-wide geothermal heating and cooling, and community gardens, among many other amenities.

Roberts Mountain

Adrienne Buck
Clyde • 828.280.0415
bestbuiltinc@outlook.com
bestbuiltcustoms.com
Lots or Home/Land packages available. Located in Haywood County. Rural setting. Easy access to I-40 and shopping. Adjacent to conservancy property. Green Built Standards in Deed Restrictions. Southern Exposures. Gentle accessibility.



Sure Foot Builders Inc.

Raymond Thompson
Asheville • 828.242.0925
surefootbuilders@gmail.com
surefootbuilders.com

We are a green home building company working in the greater Asheville area. It is our passion to build beautiful and creative homes that add value and comfort to the lives of our owners and community. In each home we strive to articulate modern green building practices.

Education



AB Tech

Heath Moody
Asheville • 828.254.1921
hmoody@abtech.edu
abtech.edu

Our programs focus on a variety of teaching techniques, including live projects. Students acquire skills in energy efficiency, renewable-energy technologies, and construction materials and methods associated with high-performance buildings. We are Asheville's training center for renewable energy, advanced framing methods, green building, energy-auditing techniques, and software associated with building-energy analysis.



Asheville Home Builders Association

Megan Carroll
Swannanoa • 828.299.7001
megan@ashevillhba.com
ashevillhba.com

Green Opportunities

Gwen Hill
Asheville • 828.398.4158
gwen@greenopportunities.org
greenopportunities.org
Green Opportunities (GO)'s mission is to train, support, and connect people from marginalized communities to sustainable employment pathways. In addition to technical training in construction and culinary arts, GO's holistic programs include wrap-around support services, high school equivalency classes, life skills training, counseling, and job placement assistance.

Henderson-Transylvania Home Builders Association

Cara Pryor
Hendersonville • 828.697.9513
hhba@att.net
henderson-transylvaniahomebuilders.com

Lenoir-Rhyne University Asheville

Michael Dempsey
Asheville • 828.407.4269
michael.dempsey@lr.edu
lr.edu/asheville
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NC Sustainable Energy Association

Raleigh • 919.832.7601
info@energync.org
energync.org
The leading nonprofit dedicated to creating clean energy jobs, economic opportunities and affordable energy to benefit all of North Carolina.

North Carolina Building Performance Association

Ryan Miller
Raleigh • 919.841.6207
Ryan@BuildingNC.org
buildingnc.org

Organic Growers School
Brandon Greenstein
Asheville • 828.214.7833
outreach@organicgrowersschool.org
organicgrowersschool.org

The Collider
Jim Fox
Asheville • 828.254.6283
info@thecollider.org
thecollider.org

Electricians

IBEW Local 238
Jason Simons
Asheville • 828.367.8445
jason.ibew238@gmail.com
ibew238.org

Energy Efficiency & Automation

Aerobarrier of WNC
Chad Thereau
Asheville • 828.201.2717
chad@aerobarrierwnc.com
aerobarrierwnc.com
AeroBarrier is an innovative envelope-sealing technology that aims to make energy-efficient and performance home-building attainable for all builders. Certified as GreenGuard Gold and Built Green, our sealing technology safely and effectively seals the entire building, eliminating problems and shortcomings of traditional construction techniques and replacing manual labour with automated operation.



Conservation Pros
Sara Sabol
Asheville • 828.713.3346
sara@conservationpros.com
conservationpros.com

Conservation Pros is a building performance contracting firm providing solutions to energy efficiency, inadequate insulation, crawlspace mold and moisture, and indoor air quality in homes and business across WNC.



Vandemusser Design
Amy Musser
Asheville • 828.348.4723
amy@vandemusser.com
vandemusser.com

We provide technical consulting and certification services for green residential construction to builders, architects, developers, and homeowners in Western North Carolina and beyond. Our company is run by an architect and engineer with extensive experience in the industry. We are here to assist with all technical aspects of green building.

Engineers



Appalachian Landslide Consultants, PLLC
Jennifer Bauer
Asheville • 828.209.8642
jennifer@appalachianlandslide.com
appalachianlandslide.com



Blue Earth Planning, Engineering & Design, PC
Tim Ormond
Asheville • 828.989.8075
tormond@blueearth.us
blueearth.us



ECS Southeast, LLP
Matthew Fogleman
Asheville • 828.665.2307
mfogleman@ecslimited.com
ecslimited.com

ECS is the premier local provider of geotechnical engineering and environmental consulting services. Our expertise includes steep slope properties, retaining walls, landslides, specialty foundations, contamination assessments, Brownfield redevelopment, and asbestos/lead/mold testing.

Geothermal Design Center Inc

Geothermal Design Center Inc.
Rick Clemenz, PE, CGD
Asheville • 828.712.6786
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IONCON
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Paul E. Fulton, P.E. Consulting Engineer - Structural & Solar PV
Paul Fulton
Asheville • 828.407.0795
pefulton5@gmail.com



Vandemusser Design
Amy Musser
Asheville • 828.348.4723
amy@vandemusser.com
vandemusser.com
We provide technical consulting and certification services for green residential construction to builders, architects, developers, and homeowners in WNC and beyond. Our company is run by an architect and engineer with extensive experience in the industry. We are here to assist with all technical aspects of green building.

Finishes - Exterior



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James Matthews
Asheville • 828.667.8555
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Interface, Inc.
Jay Lanier
Asheville • 336.749.1304
james.lanier@interface.com
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Interface is the worldwide leader in design, production and sales of environmentally-responsible modular carpet for the commercial, institutional, and residential markets. We seek to be the first company that, by its deeds, shows the industrial world what sustainability is in all its dimensions: people, process, product, place and profits.



Mountain Marble & Granite, Inc.
Tracy Pinegar
Asheville • 828.225.0001
tracy@mountainmarble.com
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carolina.e.gomes@sherwin.com
sherwin-williams.com

Square Peg Construction Inc.
Leslie Humphrey
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info@squarepeginc.net
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Jay Lanier
Asheville • 336.749.1304
james.lanier@interface.com
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Asheville • 828.253.5455
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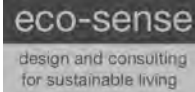
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Residential Energy Diagnostics

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Fairview • 828.337.1686
elliott@goredforgreen.com



Vandemusser Design

Amy Musser
Asheville • 828.348.4723
amy@vandemusser.com
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We provide technical consulting and certification services for green residential construction to builders, architects, developers, and homeowners in Western North Carolina and beyond. Our company is run by an architect and engineer with extensive experience in the industry. We are here to assist with all technical aspects of green building.

Home Inspectors

Asheville Inspections LLC

Andrew Erskine
Asheville • 828.242.6226
ajerskine@gmail.com
ashevilleinspections.com
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Chad Thereau
Asheville • 828.201.2717
chad@aerobarrierwnc.com
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AeroBarrier is an innovative envelope-sealing technology that aims to make energy-efficient and performance home-building attainable for all builders. Certified as GreenGuard Gold and Built Green, our sealing technology safely and effectively seals the entire building, eliminating problems and shortcomings of traditional construction techniques and replacing manual labour with automated operation.



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James Matthews
Asheville • 828.667.8555
james@bestbuymetals.com
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O&B Colonial

Michael Borst
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Jimmy Wilson
Mills River • 828.891.7040
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Rockwool

Travis Washmiller
757.677.6152
travis.washmiller@rockwool.com
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The Insulators

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Interior Designers



Alchemy Design Studio

Traci Kearns
Asheville • 828.255.5110
traci@alchemy-interiors.com
alchemy-interiors.com

Allard & Roberts Interior Design

Talli Roberts
Asheville • 828.271.4350
talli@allardandroberts.com
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D&J PROPERTIES

D & J Properties

David Walters
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Green Built Environments

Victoria Schomer
Leicester • 828.707.2919
vschomer@greenbuilt-e.com
greenbuilt-e.com



Griffin Architects, P.A.

Griffin Architects PA

Robert Griffin
Asheville • 828.274.5979
inquiries@griffinarchitectspa.com
griffinarchitectspa.com
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ID.ology Interiors & Design

Laura Sullivan
Asheville • 828.252.4403
laura@idologyasheville.com
idologyasheville.com



Stratton Design Group

Douglas Stratton
Skyland • 828.505.9500
douglasstratton1@yahoo.com
strattondesigngroup.com

Interior Finishers

MudStrawLove LLC

Steve Kemble
Asheville • 828.775.4823
connect@mudstrawlove.com
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Land Planning



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David Tuch
Asheville • 828.253.6856
David@equinoxenvironmental.com
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Providing specialized design services inspired by nature for site design, planting design, drainage and stormwater to create beautiful and functional spaces.



Otter & Arrow Land Planning
Kevin Tate
Roswell, GA • 828.551.1414
kevin@otterandarrow.com
otterandarrow.com

RiverLink
RJ Taylor
Asheville • 828.252.8474 ext. 11
rj@riverlink.org
riverlink.org



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Carrie Vogler
Weaverville • 828.777.6637
carrie@voglerllc.com
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Landscape Architects

BareRoot Designs, PLLC
Jennifer Verprauskus
Candler • 980.500.9931
barerootdesignsAVL@gmail.com
barerootdesigns.com



Equinox
David Tuch
Asheville • 828.253.6856
david@equinoxenvironmental.com
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Fusco Land Planning & Design, PLLC
Matthew Fusco
Asheville • 828.243.6604
Matt@FuscoLA.com
fuscola.com



Osgood Landscape Architects
Joel Osgood
Asheville • 828.527.6466
jo@osgoodla.com
osgoodla.com



Otter & Arrow Land Planning
Kevin Tate
Roswell, GA • 828.551.1414
kevin@otterandarrow.com
otterandarrow.com

Landscapers

Ambrose Landscapes
Steve Ambrose
Asheville • 828.768.1861
dave@reliableacorn.com
landscapingasheville.com

Gardenology, LLC
Adam Garry
Asheville • 828.337.4060
adgarry@hotmail.com
gardenology-asheville.com



Mountain Meadow Landscaping
Kyle Guie
Marshall • 828.200.2379
kyle@mountainmeadowllc.com
mountainmeadowllc.com



Otter & Arrow Land Planning
Kevin Tate
Roswell, GA • 828.551.1414
kevin@otterandarrow.com
otterandarrow.com

Trademark Homescaping
William Deaver
Hendersonville • 828.699.3495
williamdeaver1066@att.net
trademarkhomescaping.com

YummyYards
Laura Ruby
Weaverville • 828.785.8624
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Landscaping Supply



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Lenders



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Asheville • 828.776.8632
jill@alfieloans.com
alfieloans.com

Entegra Bank
Jason Chambers
Asheville • 828.524.7000
JChambers@entegrabank.com
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Mold & Moisture



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Aaron Carey
Weaverville • 828.645.4546
precisionrestoration@frontier.com
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Wood Protection Technologies
Gary McDougal
Fayetteville, GA • 858.444.0748
Sydney@woodprotech.com
woodprotech.com

Pest Control

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ESJ uses reduced risk pest control products in our exterminating services to protect your home, family, pets, and the environment.

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wthomason@prosourcesupply.com
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Realtors



Amanda Boren at Nest Realty
Amanda Boren
Asheville • 828.713.7049
afboren@yahoo.com
nestrealty.com/amandaboren



Beth Zabriskie at Nest Realty
Beth Zabriskie
Asheville • 828.273.6724
callbethz@gmail.com
nestrealty.com/ashville/agents/
bethzabriskie_katsmith.html



Bobbi Holland at Nest Realty
Bobbi Holland
Asheville • 828.275.6170
bobbi.holland@nestrealty.com
nestrealty.com/BobbiHolland

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Weaverville • 828.484.1758
kimmy@reiwnc.com
reiwnc.com

Ginny Lentz at Nest Realty
Ginny Lentz
Asheville • 828.779.9898
ginny.lentz@nestrealty.com
nestrealty.com/ginnylentz



Jackie Rocks Green at Dawn Wilson Realty
Jackie Tatelman
Black Mountain • 828.713.5193
jackie@dawnwilsonrealty.com
dawnwilsonrealty.com
A eco-certified realtor who is customer-focused and knows how to navigate the complexities of real-estate transactions, Jackie lives in a gold-certified green home that has solar PV and thermal. She has built two green homes. Jackie works with buyers and sellers in the Asheville area including Black Mountain and Marshall.

"We will have the ability in a very short time to create buildings that are literally as complex as a plant or a flower, that are biophilic in the true sense of the word."

— Paul Hawken, Trim Tab Summer 2013 interview

Jody Whitehurst at Town and Mountain Realty
 Jody Whitehurst
 Asheville • 828.215.3981
 jody@jodywhitehurst.com
 jodywhitehurst.com
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 John Senechal
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 johnsenechal.kw@gmail.com
 johnsenechal.kwreality.com



Love The Green Team
 Mary Love
 Asheville • 828.279.6723
 mary@lovethethegreen.org
 lovethethegreen.org
 Love The Green Team is a women/veteran-owned full-service real estate company. Our mission is to create a sustainable world, one home at a time. We provide services to buyers and sellers, and property management services. We are your matchmaker for the home that you love which fits your budget.



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Robbie McLucas at Town and Mountain Realty
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 robbie@townandmountain.com
 townandmountain.com



Robin Cape at Town and Mountain Realty
 Robin Cape
 Asheville • 828.216.4009
 robincap@gmail.com
 robincap.com

The Real Estate Center of Asheville Inc.
 Scott Carter
 Asheville • 828.231.5076
 scottcarter@recenter.com
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Recycling



Asheville Area Habitat for Humanity ReStore
 Scott Stetson
 Asheville & Weaverville
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 The Asheville Habitat ReStore sells donated items to the general public with proceeds supporting Habitat's building programs. Find building supplies, appliances, furniture and much more. The removal of usable materials from structures is available throughout their Deconstruction service.

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 chad@griffinwaste.com
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Waste Pro
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Renewable Energy



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 Candler • 828.808.4153
 nate@ashevillesolarcompany.com
 ashevillesolarcompany.com
 Asheville Solar Company is a small, family-run business that places honesty and customer benefit before profit.

Blue Ridge Biofuels
 Woodrow Eaton
 Asheville • 828.253.1034
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 Rick Clemenzi, PE, CGD
 Asheville • 828.712.6786
 rrclemenzi@geothermaldesigncenter.com
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 Asheville • 828.332.3003
 office@solfarm.com
 solfarm.com



Sugar Hollow Solar, Inc.
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 info@sugarhollowsolar.com
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 International Living Future Institute's Living Building Challenge



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HomeSource Real Estate & Construction, Inc.

Tim Alexander
Asheville • 828.252.1022
tim@homesourcebuilders.com
homesourcebuilders.com

Fully licensed and insured custom home builder and remodeling contractor, providing expertise and commitment in construction. Offering turnkey service, including home design, kitchen and bath design, and product selection under one roof. Current and past projects include more than 100 custom homes and hundreds of remodels from large to small.



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Hans Doellgast
Fairview • 828.216.3948
hans@jademountainbuilders.com
jademountainbuilders.com

Jade Mountain Builders is a team of 31 craftsmen who pride themselves on taking an ecologically sensitive approach to building homes.



JAG & Assoc. Construction, Inc.

Jody Guokas
Asheville • 828.216.0914
jody@jaggreen.com
jaggreen.com

JAG Construction is a small company specializing in in-town urban spec construction. Our goal is to make healthy, creative, long-lasting homes more available to the general public. We're examining new ways to reduce the impact of construction on the environment around us and preparing for a future of alternative energy.



Judd Builders

John Judd
Arden • 828.274.4448
parkerv@juddbuilders.net
juddbuilders.net

In 2007, John Judd Sr. and John Judd Jr. formed Judd Builders with a vision to build quality custom homes with sustainable and environmentally friendly materials and building practices. We look at each home like it has its own ecosystem and adjust our green-building approach accordingly to match clients' needs.



Pioneer Construction and Development Inc.

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Rare Earth Builders, Inc.

Mark Bondurant
Canton • 828.492.0534
rareearthbldrs@bellsouth.net
rareearthbuilders.com

We build high-performing, exceptionally beautiful custom homes while minimizing negative environmental impacts with attention to construction details and client comfort.



RCJ Building Inc.

Robert Jacobelly
Asheville • 828.216.4433
rcjbuilding@yahoo.com
rcjbuilding.net

RCJ Building Inc.'s custom homebuilding professionals have the knowledge and expertise that you'll need when you have the opportunity to build the house you've always wanted. We understand what goes into the building process, and more importantly, what goes through the minds of future homeowners during the build.



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We offer quality and craftsmanship in the building of green and energy-efficient homes. We offer design and build services for fully customized homes, and experience with a range of architectural styles and sizes. From start to finish, we'll work closely with you to make your dream home become a reality.



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earthtonebuilders.com

We are a leading green building company committed to the highest standards in construction quality and sustainable, healthy living.



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Tim Alexander
Asheville • 828.252.1022
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Fully licensed and insured custom home builder and remodeling contractor, providing expertise and commitment in construction. Offering turnkey service, including home design, kitchen and bath design, and product selection under one roof. Current and past projects include more than 100 custom homes and hundreds of remodels from large to small.



MOUNTAIN SUN BUILDING & DESIGN

Mountain Sun Building & Design

Emily Boyd
Asheville • 828.713.0549
emily@mountainsunbuilding.com
mountainsunbuilding.com

As both a land developer and a design/build firm, we can help clients at any stage of the new home building process. We focus on site-specific design and Zero Energy Homes, creating finely crafted, light-filled interiors that capture the beauty of and connect to their natural surroundings.



Timberframe Horizons, LLC

Tom Rouse
Fairview • 828.222.2555
tom@timberframehorizons.com
timberframehorizons.com

We are a design build firm that specializes in creating energy-efficient custom artisan homes utilizing timber frame construction.

Reuse Retail



Asheville Area Habitat for Humanity ReStore

Scott Stetson
Asheville & Weaverville
828.254.6706
sstetson@ashevillehabitat.org
ashevillehabitat.org

The Asheville Habitat ReStore sells donated items to the general public with proceeds supporting Habitat's building programs. Find building supplies, appliances, furniture and much more. The removal of usable materials from structures is available throughout their Deconstruction service.

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Emilio Ancaya
Asheville • 828.252.4449
emilio@livingroofsinc.com
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International Living Future Institute's Living Building Challenge



RCJ Building Inc.

Robert Jacobelly
Asheville • 828.216.4433
rcjbuilding@yahoo.com
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RCJ Building Inc.'s custom homebuilding professionals have the knowledge and expertise that you'll need when you have the opportunity to build the house you've always wanted. We understand what goes into the building process, and more importantly, what goes through the minds of future homeowners during the build.

Roofing Materials



Best Buy Metals, LLC

James Matthews
Asheville • 828.667.8555
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bestbuymetalroofing.com

Metal roofing manufacturer. Serving residential, agricultural, and commercial industries with next day service, on-site manufacturing, and customer trim work. Stocking all metal roofing trim and accessories.

Salvage



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Structural Materials



84 Lumber

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Asheville • 828.665.3815
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At GreenEdge Supply, 84 Lumber Company's green initiative, we can help you integrate energy, water and resource efficiency along with improved indoor air quality with our sustainable products.



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— Richard Louv,
richardlouv.com/blog



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Tom Rouse
Fairview • 828.222.2555
tom@timberframehorizons.com
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Asheville • 828.251.9973
nicole@ashevilledowntown.org
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Christmount

Rob Morris
Black Mountain • 828.669.8977
rob@christmount.org
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CompostNow

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Duke Energy

Marc Faircloth
Sumter, SC • 803.934.2535
marc.faircloth@duke-energy.com
duke-energy.com/newhomes

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Asheville • 828.250.0970
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Jeff Carter
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Stephan Ihde at Edward Jones

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Asheville • 828.277.5134
stephan.ihde@edwardjones.com
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Timberframe Horizons, LLC

Tom Rouse
Fairview • 828.222.2555
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Tiny & Small Homes



84 Lumber

Matt Pocta
Asheville • 828.665.3815
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Green Source Construction Management, Inc

Josh Scala
Black Mountain • 828.337.0284
greensourcebuilder@gmail.com
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Nanostead LLC

Jeremy Stauffer
Marshall • 828.206.2526
jstauff@gmail.com
nanostead.com

Training

Green Opportunities

Gwen Hill
Asheville • 828.398.4158
gwen@greenopportunities.org
greenopportunities.org

Green Opportunities (GO)'s mission is to train, support, and connect people from marginalized communities to sustainable employment pathways. In addition to technical training in construction and culinary arts, GO's holistic programs include wrap-around support services, high school equivalency classes, life skills training, counseling, and job placement assistance.

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Builders FirstSource is driven by the desire to provide professional-class building materials and services to homebuilders and remodelers nationwide.



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Joe Archibald
Asheville • 828.273.9509
joe@narwhalbuilt.com
narwhalbuilt.com

*Craft-based design & fabrication firm providing architectural design and custom woodworking, utilizing environmentally preferred products and guide by social consciousness.**



Sage Builders
Doug Keefer
Asheville • 828.713.7208
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