





BUILDING GREENER

BUILDING BETTER

The Quiet Revolution

THE NATIONAL ASSOCIATION OF HOME BUILDERS
AND THE NAHB RESEARCH CENTER

Building Greener, Building Better

GREEN BUILDING, ONE OF THE MOST SIGNIFICANT DEVELOPMENTS IN HOME BUILDING in the past three decades, is nothing less than a quiet revolution in the way that new homes and communities are planned and constructed.

Broadly defined as building new homes in a manner that conserves resources, green building can include numerous elements affecting virtually every aspect of the development and construction process and the physical structure of the house. Generally, it involves one or more of the following:

- Land planning and design techniques that preserve the natural environment and minimize disturbance of the land.
- Site development to reduce erosion, minimize paved surfaces and runoff and protect vegetation, especially trees.
- Water conservation indoors and outdoors.
- Energy efficiency in heating/cooling systems, appliances, lighting and the building envelope.
- Selection of materials based on recyclability, durability and the amount of energy used to create the material.
- Waste reduction, reuse and recycling during construction and throughout the life of the home.

Perhaps the most important aspect of green building is that it is not an "all or nothing" endeavor. When carefully selected and implemented, even modest measures can result in significant conservation of resources. Green building is also uniquely local. Because climates, customs, availability of materials and preferences vary so much throughout the nation, green building measures that are essential in some areas may not be appropriate for others.

Nor does green building require sacrificing comfort, convenience and style or using complicated and expensive cutting-edge technologies.

Although they are inherently more resource efficient than their non-green counterparts, today's green-built homes are indistinguishable from other homes. What's more, use of even tried and true methods and off-the-shelf technologies can result in significant energy savings and resource conservation.

A particularly significant aspect of the quiet revolution in green building is that it is largely industry-driven and voluntary; home builders are in the vanguard of residential resource conservation.

Lacking unwarranted government intrusion in the form of onerous, impractical regulations, and with the support of the public that it serves, the home building industry can continue to make the nation's homes even greener and more resource efficient.

Green Building And Community Planning: The Link To Smart Growth

Green building goes hand-in-hand with another of the nation's leading concerns, Smart Growth, by blending innovative, voluntary approaches to land use planning, material selection and environmental protection while providing for a mix of housing.

"Twenty years ago, when we talked about green building, we talked about energy efficiency and solar power," said Jim Leach, one of Colorado's leading developers and home builders. "But it has evolved into something more comprehensive. Now we relate that to more progressive things such as how you situate houses on the land and in neighborhoods, and attractive and sustainable developments for people that are more environmentally conscious. In that respect, green building fits within Smart Growth."

Market economics also come into play. Leach recalls that when he built the Wonderland Hill planned community in Boulder in the 1970s, "we did everything from townhouses all the way to single-family detached homes. A diverse housing market is key to its success. We were trying to create a place that works environmentally and socially."

The result was housing by choice, housing with energy efficiency and housing in a community with walkable streets. Leach was once asked if Wonderland Hill is an example of neotraditionalism, green building or both. "Those two concepts go together," he replied. "They have a lot in common, and at Wonderland Hill the two can bump into each other. We have a place where people can live and interact in a sustainable way."

Greg Schwinn, a home builder from Lincoln, Neb., noted that green building is similar to Smart Growth in terms of land development practices. "A lot of builders and developers are using development practices that combine low cost and sensitivity to the environment," Schwinn said. "So you see more and more efficient street layouts, and neighborhood connectivity. Streets are becoming narrower to encourage pedestrian friendly streetscapes. There are also best management practices happening that retain, slow the flow of and clean storm water. This eliminates the need for costly underground storm water systems. Developers are also integrating storm water retention facilities with open space amenities and preserving trees by keeping disturbance of the existing terrain to a minimum. To me, all of this constitutes green building and smart growth."

Wonderland Hill Development Co. provides co-housing at River Rock Commons in Ft. Collins, Colo.

Harmony Village (both photos), Wonderland Hill's development in Golden, Colo.

Green building and Smart Growth principles are being applied on a regional level as well according to Ken Dierks and Vaughn Rinner of Landmark Design Group in Virginia Beach, Va. "You cluster not just in your subdivision or development but through mixed uses and where land uses will go, so that you have total community resources," Rinner explains. "It's clustering on a macro level."

The Need for Sensible Regulation

Open space preservation has become a major issue for localities across the country as they grapple with rapid growth. Often the need for growth and the need for recreational space are balanced through proper planning and open space area acquisition programs. But problems can arise if certain parcels become too expensive. According to Environmental Consultant Chuck Stewart, the president of Urban Forest Management, Inc. in Fox River Grove, Ill., this is where flexibility is needed. "Maybe the localities should try something different like allowing developments that include conservancy areas. Here in the Midwest, we have forest reserve districts, and park districts, so why not allow open space in perpetuity in exchange for something the builder could use?"

Another problem is the reluctance of localities to promote successful public-private joint efforts that combine Smart Growth and green building. "There is not much advocacy for success groups besides home builders," Rinner says. "There aren't many municipalities that tout these things."

Using Smart Growth and Green Building to Create Community

Ultimately, the greatest challenge facing Smart Growth proponents and green building practitioners alike will be successfully integrating the environmental, housing, economic and social goals that make up a community. "In our promotional materials, we state that community is the secret ingredient of sustainability," Leach pointed out. "I think that's why you are seeing a merging of Smart Growth and sustainability with green building. The Sierra Club chapter in our area promotes the concept of infill and compact development. We do too. We are not just promoting a product, we are promoting a way of life."

Green Building Trends In Land Development and Site Design

One of the key aspects of green building is its emphasis on making the best possible use of a site and preserving its most important and unique features.

To accomplish this, one of the first things builders and developers do when they consider the land development possibilities for a site is to conduct "an opportunities assessment," according to Ken Dierks of Landmark Design Group, an environmental planning firm in Virginia Beach, Va. "You look at your natural features as amenities and then see what you have left over."

"The real trend is the whole idea of heritage and preserving a sense of place," said Vaughn Rinner, another principal and lead planner with Landmark. "This is what people are looking for in their communities."

Green building is also gaining more practitioners because it helps developers save on development costs. "A good site planner will design streets, infrastructure and building footprints and locate them in such a way as to reduce the amount of site excavation," explains Ron Tyne, a developer from Little Rock, Ark. This reduced site excavation, combined with efforts to preserve natural drainage basins and existing vegetation is creating a new green building trend known as "low-impact development."

Environmentally friendly site design, tree preservation and storm water maintenance swales can add value to new communities such as Clear-meadows in Vancouver, Wash.

Land development techniques that "cluster" homes close to each other and preserve trees, wetlands, meadows and other natural amenities as public or private open space are also staples of green building.

Chuck Stewart of Urban Forest Management, Inc. in Fox River Grove, Ill., sees more of his developer clients using this technique as a way to save tree stands. "Say you have a hundred acres and those 100 acres are zoned for one house per acre. You could spread this out and also put in roads and infrastructure. But suppose you could take these 100 houses and put them on 50 acres. Now you have gained 50 acres of open space. The amount of open space in your second option is bigger, and you don't have to put in as many streets, roads and pipes. From a developer's point of view, clustering is something that can be accomplished. Unfortunately, a lot of local governments don't understand the concept. Or they think clustering means higher densities that are unattractive."

> *"The real trend is the whole idea of heritage and preserving a sense of place. This is what people are looking for."*

Denver's Elitch Gardens: An "Amusing" Transformation

With acres of asphalt parking lots, rides begging for maintenance, and a few quaint old structures reflecting past glory, Denver's Elitch Gardens was a classic example of an aging amusement park. It also had two elements not found at most former amusement parks: a handful of ornamental gardens—a holdover from the days when the family-owned amusement park was known more for gardens than for rides—and a location just a few minutes from downtown.

For decades, Elitch Gardens was a family-owned park featuring gardens, a popular theater, a carousel, and—in later years—a number of amusement rides. The Six Flags group ultimately acquired the Elitch name and moved the amusement park to another part of Denver.

HGV Land Company then purchased the site and prepared a site plan based on a vision of Smart Growth land-use techniques and leading-edge green building methods.

Now, Elitch Gardens is being turned into a pedestrian-friendly, mixed-use development called Highland's Garden Village that emphasizes green building techniques. The completed 27-acre urban infill site will include 291 living units and 90,000 square feet of commercial space.

The housing component of the project includes a seniors housing complex, single-family detached homes, row homes—the development team's term for townhomes—and co-housing. A commercial component will be done in later phases.

"Highland's Garden Village is a prime example of green building for two reasons," said Jake Wegmann of Burgwyn, Perry and Rose, LLC, part of the development team. "First, it has an urban infill location that offers great pedestrian connections and easy access to existing transit facilities. Second, all of the single-family homes, townhomes and co-housing at Highland's Garden Village will meet the high standards of both Built Green Colorado, a green building program, and E-Star Colorado, a home energy ratings program." Developed and administered by the Home Builders Association of Metropolitan Denver, Built Green Colorado is a statewide voluntary green building program that encourages the use of products and practices that demonstrate energy, water and natural resource efficiency. Homes registered in the program meet a minimum number of options selected from the Built Green Checklist.

"With its high-density, pedestrian-oriented urban infill and easy access to mass transit, Highland's Garden Village is definitely Smart Growth," Wegmann added. "It will have an overall density of 11 homes per acre, and that does not even take into account the 90,000 square feet of planned commercial space. It's mixed use. The homes are alley-loaded. There will be less impervious surface on this site, not more. It will include green spaces. The list goes on and on," Wegmann said.

Debris from the demolition of the old Elitch Gardens amusement park was recycled.

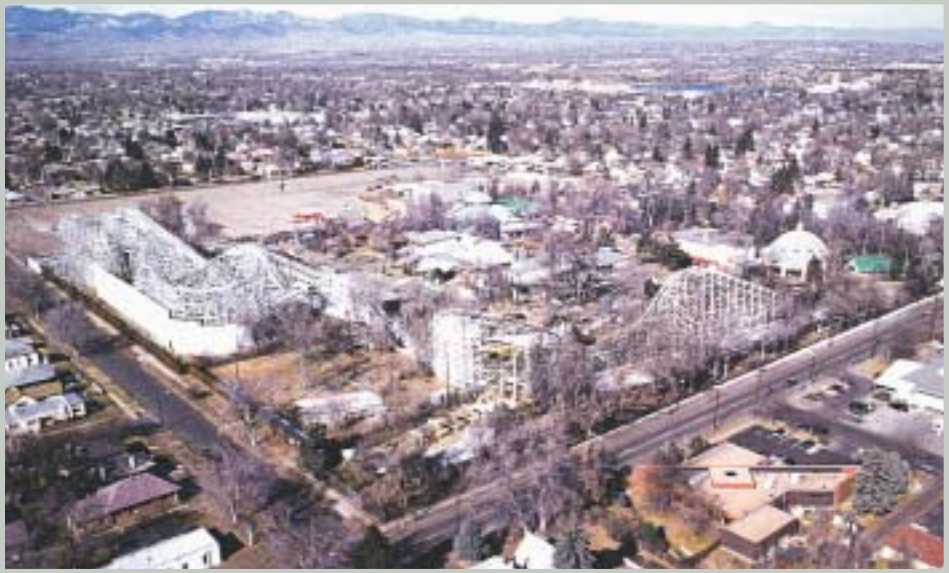
Highlands Garden Village, a new infill community at the site of the old Elitch Gardens amusement park, includes a mix of housing.

Where possible, the development team has used existing materials and facilities. The developers began by crushing 30 tons of existing concrete and asphalt on site and using it as road base for the village's streets and alleys. The new development will preserve the old theater as a performing arts facility and community center, and the carousel pavilion will serve as a community gathering place.

Wonderland Custom Builders, based in Lafayette, Colo., is doing the single-family and row homes within the development. The company is known for its commitment to green building, noted Kim Calomino, director of Built Green Colorado.

At Highland's Garden Village,

Once Denver's most popular amusement park, Elitch Gardens is being transformed into a newly redeveloped community.



Wonderland's green building features will include:

- Energy efficient mechanical systems.
- Engineered lumber products.
- Energy efficient water heaters and home appliances.
- Interior doors made of reconstituted or recycled materials.
- Insulated exterior doors.
- Fly ash concrete (which incorporates waste from coal-fired power plants to create stronger concrete).

The homes will also meet Colorado's E Star Program, said Steve Doane, president of Wonderland Custom Homes.

"E Star Colorado is a home energy rating system," Calomino said. "Each home is tested to determine its energy performance, like a miles-per-gallon sticker on a car. The results give you the anticipated energy efficiency of the home."

The E Star program looks at a number of factors, including solar orientation, window area, insulation package and appliance efficiencies. A blower door test is done to determine air leakage. Results of the assessment criteria are factored to derive a rating on a point scale of 0 to 100. A minimum of 80 points is required to qualify as an E Star home.

Another interesting twist of the project will be 34 co-housing units located on just two of the 27 acres. Co-housing is a European model in which families have individual living spaces but share common areas such as dining facilities. The co-housing builder is Jim Leach, a founder of Wonderland Custom Homes who now focuses on co-housing.

"This is a wonderful project. Community design and home design really work together to emphasize green design," Leach said. "Green design is more than just environmentally sound. It's also good business, Leach added. "It costs more to build at an urban infill location, but you can get a lot more for it. We're getting 20 to 50 percent more per square foot here than in comparable suburban developments."

"The commitment to green building at Highland's Garden Village has been very worthwhile," Doane said. "This is a unique development. From the developer to the builders to the consumers, everyone recognizes this is special."

Green Building and Multifamily Construction: Building a Bridge to Smart Growth

What can a multifamily builder constructing apartments, townhouses and condominiums contribute in the way of green building and Smart Growth? Plenty, according to Maryland home builder Tom Bozzuto.

"We sort of look at green building as a two-part process—inside the building, and outside," Bozzuto, president of Greenbelt-based The Bozzuto Group explained.

On the inside, today's multifamily residences have taken a quantum leap forward in terms of energy efficiency. "We are all doing a better job of insulating, and our heating systems have changed, especially in the mid-Atlantic area. Years ago, heating in apartments was typically all electric. Today, the industry is commonly installing a hot water system that heats the unit with domestic hot water heated by gas. Instead of having heat sources, you are using one system that is extremely efficient doing two jobs."

Another trend, individual metering for gas and electricity, started after the 1972 energy crisis and has given tenants control over energy efficiency and an incentive for conservation. That trend has been extended to water service. "The theory is that when a consumer is not paying for a product directly, they are much less discriminating in its use, but if they pay for water directly, they are much more conscious of its use or abuse," Bozzuto says. "I think this amounts to social awareness," he points out. "You are asking people for accountability."

By their nature, multifamily construction and development are good for the environment, because higher density in established or suburban locations means less development pressure on 'greener' outlying areas. "The argument is, if I put 30 homes on one acre of ground, a lot of land elsewhere goes untouched," Bozzuto explained.

But there are tradeoffs. For example, the higher the density, the greater the need for parking. Bozzuto's firm has solved the parking dilemma by hiding parking areas. "More and more, we are incorporating parking inside the house or within the building," he says. "It is more expensive to have the parking in the building, but for us it makes sense. Customers pay to have the parking, but they are also paying for the privilege of

Green Building in Urban Areas Requires Brownfields

Throughout the nation, there are more than 500,000 potential residential construction sites in desirable, close-in areas where expansion or redevelopment is complicated by real or perceived environmental contamination. Hundreds of thousands of those "brownfields"—abandoned, idled or under-used sites—are believed to be suitable for new development including infill housing, but unfortunately liability concerns make most of them unattractive to private sector builders and developers.

Typically in or near prime locations, brownfields can possess tremendous redevelopment opportunity for builders and developers. If done correctly, brownfields revitalization presents a unique opportunity to marry economic development with the principles of smart growth and environmental protection. Brownfields redevelopment has the potential to slow the development of open space and farmland by presenting property owners and developers with access to brownfields sites in desirable locations with existing infrastructure and affordable pricing. Additionally, brownfields redevelopment is consistent with the notion of re-establishing communities. Many brownfields sites are located in urban areas or close-in suburbs within walking distance or in close proximity to existing amenities such as restaurants, shops and the arts. This proximity fosters a sense of community.

But brownfields redevelopment requires cooperation between the public and private sectors and all levels of government. The challenge that brownfields pose to a community redevelopment effort is two-fold. First, existing federal environmental laws such as the Comprehensive Response, Compensation, and Liability Act (CERCLA), commonly referred to as Superfund, strongly discourage the redevelopment of contaminated property by holding current and future property owners financially liable to cover clean-up cost due to contamination by past owners. Second, Superfund provides a mechanism for current or future owners to sue previous owners to recover clean-up costs.

These two elements of Superfund strongly discourage developers and

not seeing the parking."

Chuck Covell, vice president of Bozzuto Homes, said the company also uses vegetation and cutting-edge biorentention ponds wherever it is feasible to manage storm water. Covell notes that "plant material and organic material can extract oil and grit and phosphorous and nitrates from the water. You can't beat nature. It is more expensive, but at the end of the day it is the better process. It's on-site environmental stewardship." The Bozzuto Group uses bioretention ponds wherever possible because "there are a lot of things that you can affect environmentally on the site, in a positive way," Covell says. "These facilities are real ponds that can function as habitat as opposed to dry storm water ponds."

From a marketing perspective, Bozzuto believes green building helps differentiate his product from his competition. "Taking the time to spend more money and doing a quality job is part of our reputation," he says. "We are marketing green space, not parking lots. I think the consumer is becoming more conscious of the environment, and evaluates the environmentally conscious builder in a way that translates into value and quality."

Nevertheless, Bozzuto believes both green building and Smart Growth are works in progress. "Smart Growth really is the intelligent use of natural resources in a manner that respects market forces. By market forces, I mean that people want a certain lifestyle. The builder's role is to give them that. We try to be responsive to what people want and what they need environmentally. Having said that, I don't think you can dictate to the American customer that there is only one way to build," he added.

Worman's Mill in Frederick, Md., provides both single- and multifamily housing.

Reform

banks from considering former commercial or industrial sites as potential redevelopment areas, further hampering local government efforts to encourage redevelopment.

Many states have adopted state environmental laws similar to the federal Superfund rules, further discouraging redevelopment of commercial or industrial sites. However, approximately 40 states have recognized the unintended impact on redevelopment that these state environmental laws have caused by imposing severe enforcement and liability regimes on owners of contaminated properties (e.g., brownfield sites). As a result, these states have implemented programs that seek to encourage redevelopment of

In Pittsburgh, before brownfields cleanup, this slag pile occupied a spot near Frick Park above the Monongahela River.

Green Building and the Connection to Water Resources and Water Quality

Green building principles are also being used to address storm water management concerns. When a developer begins construction at a site, grading is one of his first tasks. Grading amounts to rearranging the earth to create a flat spot for a house and rearranging the topography so that street grades are safer for traffic. Grading is also done to contour the land so that water drains away from the houses.

In the past, sites were engineered so that water was collected from roads, driveways and other hard or "impervious" surfaces where water is not absorbed through above and below ground pipes. But builders are increasingly using greener methods of managing storm water. For example, developers are increasing the amount of

At Fisher's Landing in Vancouver, Wash., building green means retaining trees and planting vegetation that can remove pollutants and sediment from storm water.

BROWNFIELDS *(continued)*

contaminated properties by offering both liability and enforcement protections from any possible future state action for innocent landowners who successfully complete a state voluntary clean-up program. Incentives offered by states under their brownfields or voluntary clean-up programs range from complete indemnity to:

- ► Liability protection from future state enforcement actions.
- ► Guaranteed review timeframes of site clean-up plans.
- ► Providing the developer the choice of flexible clean-up standards based on the end use of the property (e.g., industrial, commercial or residential).
- ► Economic incentives in the form of grants, loans or tax incentives designed to offset the costs of clean-up.

Among the more successful state programs are those in Illinois and Pennsylvania that combine all of these elements along with a strong working relationship with local governments. Brownfields redevelopment in these states has succeeded to the extent that it has because both states have strong voluntary clean-up programs that provide developers certainty as to what is expected of them, coupled with strong liability and enforcement protections from any state action. Many states also offer financial and technical assistance to developers doing brownfields remediation. For example, New Jersey has established a funding program that includes bonds, revolving loans and tax abatement for brownfields projects, and Michigan recently passed a major bond initiative to help defray the costs of cleaning up contaminated sites.

For the most part, states have taken the appropriate approach by focusing on incentives for developers to engage in brownfields redevelopment rather then viewing brownfields as an alternative to suburban expansion. Despite these efforts by states and local governments to encourage brownfields redevelopment, very few projects have been completed.

Fortunately, there is now a federal brownfields statute to complement existing state brownfields programs or

pervious surface on their sites where it is feasible so that water can sink down into the ground and recharge the groundwater supply.

Another way to build green is by planting vegetation whenever possible. Certain kinds of vegetation remove pollutants and sediment from storm water while providing habitat for birds and wildlife. In the Pacific Northwest and other wet climates, builders are voluntarily improving storm water management and water quality through the use of biofiltration swales, wet ponds and constructed wetlands.

Builders are also saving, planting and transplanting more and more mature trees because the roots of sizable tree stands act as water purifying filters. "If you retain larger portions of a woodland next to your site, it will improve water quality" Chuck Stewart of Urban Forest Management in Fox River Grove, Ill., points out.

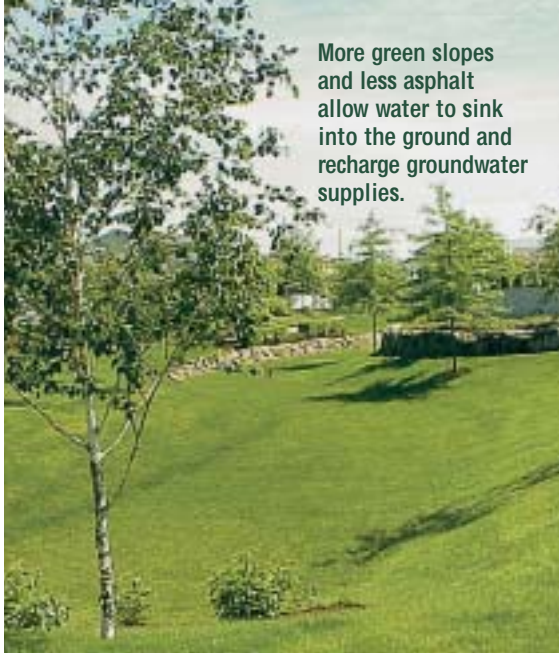
Reducing the amount of water running off residential streets and commercial parking lots can help alleviate environmental problems associated with conventional development, according to Rich Claytor, principal engineer for the Center for Watershed Protection in Ellicott City, Md.

"The traditional approach for protecting streams has not worked well," Claytor said. Retention facilities, for example, "typically do nothing to control channel erosion or pollutants."

Small streams "start unraveling as you urbanize," he said. And just a small townhouse development can enlarge a channel to six times its natural state.

Claytor has been convening local site planning roundtables to convince local governments that old, inflexible ordinances need to be cast out and replaced by innovative techniques that protect watersheds.

Claytor's approach starts with reducing the widths of collector and



Clearmeadows, Vancouver, Wash.

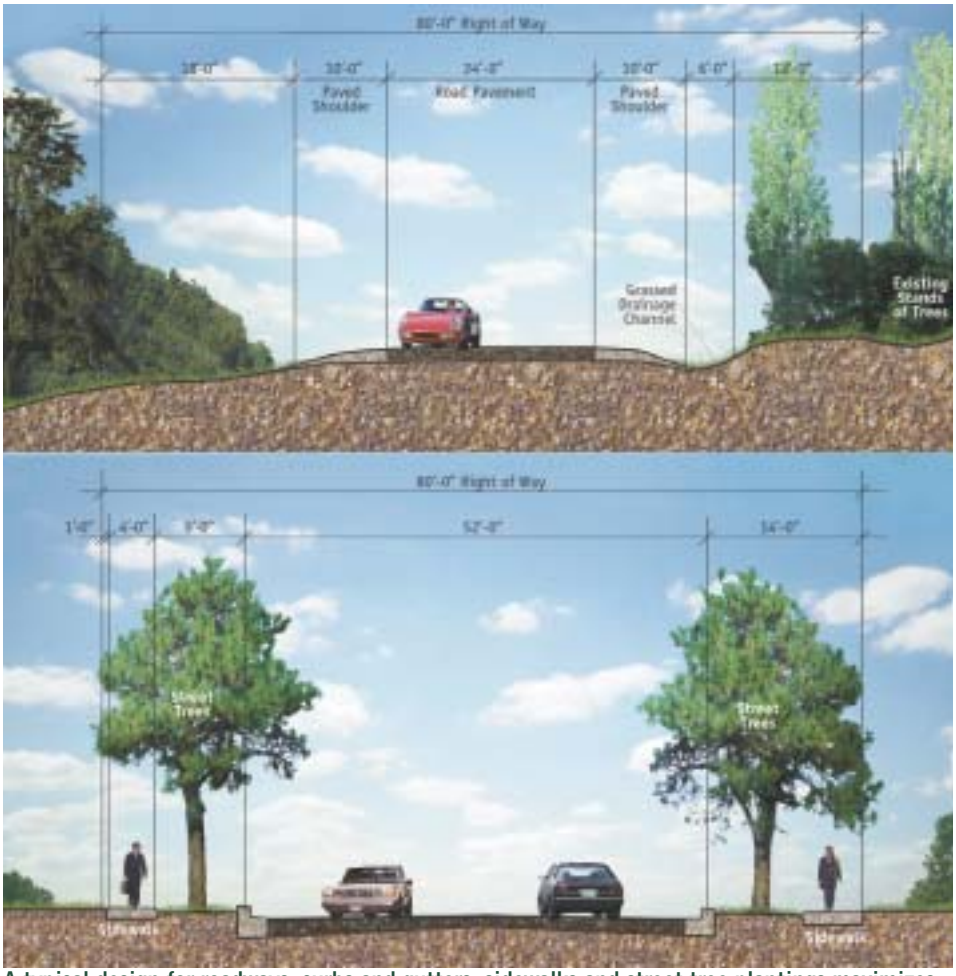
subdivision roads to the minimum amount of pavement needed to accommodate local travel and parking needs and to provide access for emergency, maintenance and service vehicles.

A 44-foot-wide neighborhood street makes "a good drag strip," but it could probably function just as well if it were winnowed down to a width of 26-feet,

voluntary clean-up programs. On January 10, 2002, President Bush signed into law H.R. 2869, the Small Business Liability Relief and Brownfields Revitalization Act. The new law provides a measure of protection for a developer or builder from federal enforcement actions under the Superfund statute. Additionally, the new law provides authorization for $200 million in annual EPA brownfields redevelopment grants.

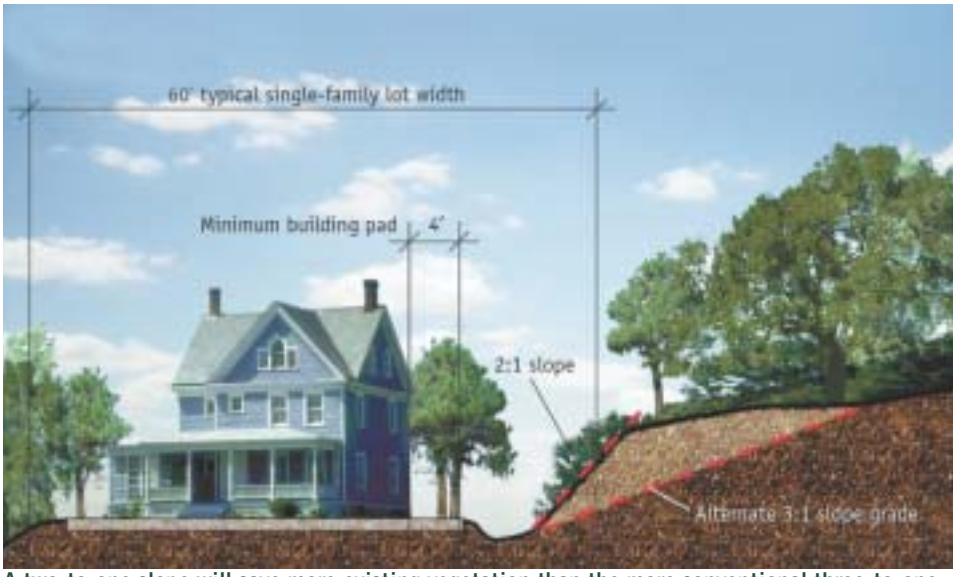
Unfortunately, the new law limits liability and enforcement protections to Superfund only, which does not cover properties contaminated with common pollutants such as petroleum, lead-based paint or asbestos. While the new law is a good first step in the redevelopment of brownfield sites, Congress can go further to provide incentives to redevelop the entire universe of brownfield sites. Specifically, the law should be extended to provide complete protection against federal liability and enforcement authorities under RCRA (Resource Conservation and Recovery Act) for innocent landowners (e.g., developers and future owners) who successfully complete a state brownfields or voluntary clean-up program.


In Pittsburgh, after brownfields cleanup: an artist's rendering of Summerset at Frick Park, a new urban community.



SOURCE: THE MICHAEL T. ROSE CONSULTING COMPANY, INC., LAUREL, MD. GRAPHICS BY PHILIP ZIMMERMANN.

A typical design for roadways, curbs and gutters, sidewalks and street tree plantings maximizes hardscape and minimizes tree space (bottom). An alternative design narrows roadways, provides natural drainage and saves existing stands of trees (top).



A two-to-one slope will save more existing vegetation than the more conventional three-to-one slope, which disturbs more of the natural topography and thus removes more trees.

providing two eight- to nine-foot travel lanes and one parking lane, he said. Narrower streets are also safer, and narrower lots with shorter frontages can cut street lengths.

Locating utilities and storm drains within the pavement section of the right-of-way—not out in the grass—can minimize the total clearing for the street, sidewalk and open channels and provide bigger back yards with less clearing.

Cul-de-sacs are frowned upon, said Claytor, because they create excessive impervious cover, but an island of green space in the middle of the street breaks up the paved surface and can provide a place for storm water to drain back into the ground. Vegetated open channels that slow the flow of water and provide infiltration are a recommended alternative to standard curb and gutter. Channels should be a bit wider than the standard two feet used in typical drainage.

Claytor also said that parking lots are too large. Two-thirds of parking lots at shopping malls are empty on any given day. Only a few are totally full at even peak periods. Lots can be further downsized by cutting stall sizes and designating a larger percentage of spaces for compacts.

Rain gardens, which are shallow vegetated depressions in the parking lot functioning as bioretention filters, can help manage storm water at the source.

As for residential lots, Claytor recommended modifying their geometry for the sake of keeping larger natural tracts of land intact, relaxing setbacks and frontage distances, building sidewalks only on one side of the street, using brick pavers or other alternative materials for driveways and building shorter, or even shared, driveways.

He also recommended directing rooftop runoff to lawns instead of drainage systems.In general, Claytor said that practitioners of his site design principles can expect to incur lower development costs but will have to pay a little more for maintenance .

"Building With Trees" Emphasizes Protection

Voluntary tree and woodland preservation are two of most visible and important trends in green building.

Not only do voluntary efforts preserve the natural environment and enhance a community, they make homes more desirable to buyers and may help forestall the type of onerous regulations that have resulted from other environmental concerns.

In 1998, the National Arbor Day Foundation instituted the Building With Trees program in cooperation with the National Association of Home Builders. The program emphasizes tree protection during land development and construction.

According to officials of the National Arbor Day Foundation, a nonprofit educational organization dedicated to tree planting and environmental stewardship, planning accounts for 90 percent of the success in preserving trees during development. In fact, officials say it is crucial to include a tree expert on the development team from the beginning, before the site plan is developed.

The tree expert is responsible for preparing a tree conservation plan that shows which trees will be saved and which will be removed; determining the location of tree protection fencing; and deciding where root pruning is needed and how to use mitigation techniques when excavation and fill cannot be avoided.

The Building With Trees concept also makes excellent business sense, according to Chuck Stewart of Urban Forest Management, Inc.

"Trees create residential communities of lasting value that appeal to significant segments of the home buying market and increase home buyer satisfaction," said Stewart. "Learning how to implement the planning, construction and maintenance process of Building With Trees can help builders save trees, time and money while increasing project success."

The National Arbor Day Foundation is not the only environmental organization that encourages and recognizes home builders who are committed to tree conservation and planting during construction.

The Michael T. Rose Companies, based in Laurel, Md., received the Audubon Naturalist Society's first Corporate Award in 2000 for its efforts to preserve trees and other natural features in its residential community designs. The Rose Companies' Laurel Lakes Development was singled out as an early example of "Smart Growth." The development features a shopping center and offices within walking distance of many homes, plus a series of walking trails and lakes that were made more nature-friendly by the addition of waterside plantings.

"As the population expands, large-scale development must have a minimal impact on the environment, provide links to mass transit and create habitat for native plants and animals. Communities can live with nature, as the Rose Companies' corporate logo proclaims," said a spokesman for the Audubon Naturalist Society.

Energy and Environmental Advances in Ho

Oriented Strand Board (OSB), which uses smaller trees and parts of the tree that were not previously used, has offered an alternative to plywood and board products for **roof sheathing**. OSB does not require the larger, older trees from which plywood and board sheathing were made in the past.

Tree preservation around a home provides shade, reduces energy costs by cooling the home and creates residential communities of lasting value.

More durable **roof coverings** such as steel and fiber-cement reduce the frequency at which a new roof is needed.

Windows now have insulating glass and low-E glass to keep homes more comfortable and energy efficient.

Vinyl siding and fiber-cement siding have reduced the need for cedar, redwood and other wood products historically used on **exterior walls**.

Increased **insulation** levels in walls and attics make the home more resistant to energy loss, lowering energy bills, reducing pollution related to energy production and saving precious resources.

Passive solar design takes advantage of the sun's "free" energy to help heat homes through glass that is oriented toward a southern exposure.

Most **exterior doors** are now insulated.

Xeriscaping uses native plants that require little to no watering by home owners.

High efficiency **heating, cooling, and water heating equipment** have reduced the amount of energy used in homes.

Foundation insulation is now installed in most homes, reducing energy losses from one of the last remaining major "sinks" in the home, and providing warmer, more comfortable floors.

using Construction

Water-saving appliances and plumbing fixtures reduce the amount of water used in homes. They also require less energy to heat water.

Recycled plastic "lumber" and alternative treatment methods are reducing reliance on chemically treated wood and valuable woods like redwood that are used for decks, porches, trim, and fencing.

High-efficiency refrigerators use much less energy than older models, and rely on refrigerants that have much less impact on the ozone layer.

Factory-built components such as trusses and pre-engineered lumber allow manufacturers to carefully plan how they use materials, making the most out of every piece of lumber. These components eliminate the need to cut wood on the job site, further reducing waste.

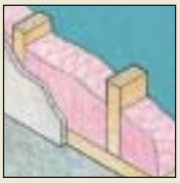
OSB and laminated fiberboard have replaced plywood and board **sheathing in walls**. OSB and fiberboard do not require the larger, older trees from which plywood and board sheathing were made in the past.

Wood **flooring** has been losing market share to carpet, sheet goods and laminates. These replacement products have significantly reduced reliance on diminishing lumber supplies.

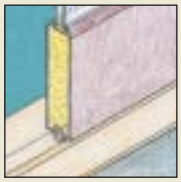
Illustrations: Vitullo Architecture Studio

Roof sheathing and coverings
In 1978, plywood made up 89.1% of the roof sheathing market; by 1999, use of plywood in roof sheathing had dropped to 27%. Plywood has been replaced by Oriented Strand Board (OSB), which now comprises more than 70% of the market.

Floor sheathing
Use of plywood has declined, from 90% of the market in 1978 to 26.7% in 1999, largely due to OSB which made up 34% of the materials market as of 1999.



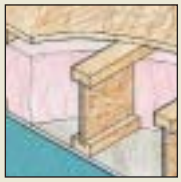
Insulation
Between 1978 and 1999, the typical level of insulation in walls increased from R-11 to R-13. Typical insulation levels rose from R-19 to R-30 in ceilings/attics.



Exterior doors
Use of insulated doors increased from 44% in 1978 to 85.2% in 1999. Use of insulated steel doors increased from 38.5% in 1978 to 87% in 1999.

Windows
Between 1978 and 1999, use of low-E coated windows grew by almost 30%; the use of insulated glass increased from nearly 68% to 87%.

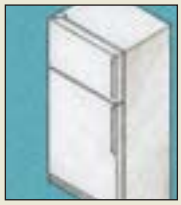
Heat pumps and furnaces
Gas and oil furnaces with greater than 80% efficiency comprised 89% of the market in 1999. Nearly one out of every three air conditioners manufactured in 1999 had a SEER (Seasonal Energy Efficiency Ratio) rating of 12 or above.



Roof and floor framing
The market share of more environmentally friendly floor trusses and I-joists went from 2% in 1978 to 29.2% in 1999, while use of dimensioned lumber for floor framing dropped by more than 20%.

Plastic "lumber"
The use of plastic "lumber" in decks has grown steadily since 1978, helping reduce use of redwood in decks from 20.1% in 1978 to 6.3% in 1999.

Dishwashers
Typically, dishwashers manufactured in 1997 use 40% less energy than models manufactured in 1972, according to the Whirlpool Corporation.



Refrigerators
In 1972, according to Whirlpool, a typical refrigerator had 18 cubic feet of capacity and used about 2000 kilowatt hours per year; by 1999, the amount of energy needed for a 20 cubic foot refrigerator had been reduced to 600-700 kilowatt hours per year.

Toilets
Toilets installed in homes in 1999 used only 1.6 gallons of water per flush,compared to 4 gallons per flush in the 1970s.

Washing machines
Use of energy by washing machines has declined by roughly 45%.

The NAHB—DOE Voluntary Energy Efficiency Program Initiative

Six programs designed to reduce energy usage in new and existing homes have been recognized by the U.S. Department of Energy (DOE) and the National Association of Home Builders (NAHB) as examples of exemplary market-driven, voluntary approaches to achieving energy efficiency in U.S. homes. These are:

1. Edison Electric Institute's E Seal program.
2. Comfort Home.
3. The Environmental Protection Agency's ENERGY STAR program.
4. The Johns Manville Performance Home program.
5. The Alaska Craftsman Home program.
6. Certainteed's Certified Plus Home program.

Recognition of the programs in 2001 culminated an initiative by NAHB to achieve federal government acceptance of voluntary partnerships developed by builders, utilities and other energy groups to advance residential energy efficiency.

Homes built today are 100 percent more energy-efficient than homes built in the 1970s. Despite these advances, energy consumption remains an important national issue.

NAHB believes such programs can help save energy and create value for home buyers. The programs are voluntary, market-driven initiatives that exceed Model Energy Code requirements without generating more red tape and regulations.

At a 2001 event to announce DOE recognition of the programs, Dan Reicher, then DOE Assistant Secretary for Energy Efficiency and Renewable Energy noted that "to date, more than 300,000 energy efficient homes have been built under these programs, saving consumers throughout the country an estimated $46 million in utility bills annually. By using less energy, these efficient homes are reducing air pollution by 108,000 metric tons annually. That's the equivalent of taking 81,300 cars off the road each year. And they are built at a cost comparable to that of conventional homes."

DOE, NAHB, and the six voluntary programs recognized have adopted the goals of the Partnership for Advancing Technology in Housing (PATH), an initiative launched in 1998 by the Clinton Administration. The PATH goal calls for new homes to be 50 percent more energy-efficient by 2010.

"In the last 25 years, energy efficiency of new homes has doubled," said NAHB Energy Subcommittee Chairman Eric Borsting, an energy consultant from Canyon Country, Calif. "Homes built today are 100 percent more energy-efficient than homes built in the 1970s. Despite these advances, energy consumption remains an important national issue. NAHB believes that voluntary, market-driven initiatives can help us increase the energy efficiency of the nation's housing stock. Programs that benefit buyers, builders, and lenders stand the best chance of succeeding because the market acts as a driving force to create change. We appreciate DOE's recognition of these programs."

State HBA Environmental Collaborations

The Ohio Home Builders Association, the Home Builders Association of Connecticut and the Home Builders Association of Alabama have all worked with state environmental agencies to develop programs that protect the environment. Their experiences can provide insights and important information for others interested in putting forth sound, workable solutions to environmental challenges such as wetlands restoration, open space preservation and storm water management.

The Ohio Wetlands Foundation

Ohio is home to an unusual program that promotes economic development, preserves and restores wetlands and natural resources and provides many species, including endangered or threatened ones, with new places to nest, feed and raise their young: the Ohio Wetlands Foundation.

The nonprofit Ohio Wetlands Foundation was formed by the Ohio Home Builders Association in 1992 to provide cost-effective, high quality wetland mitigation options and to fund wetlands research and education. Subsequently, the foundation created one of the first wetlands mitigation banks in the country.

Mitigation banks are large areas of constructed, restored or preserved wetlands set aside to compensate for unavoidable impacts associated with land development. When builders cannot avoid wetlands, they purchase credits in a mitigation bank where wetlands are being restored and/or created. The consolidation of wetlands mitigation efforts results in larger functional wetlands systems which are protected and maintained in perpetuity by professional resource managers.

The development of compensatory wetlands mitigation credits follows the guidelines developed by a federal interagency task force and published in the Federal Register in 1995 by the Army Corps of Engineers. Any entity wishing to use off-site compensatory mitigation must follow the rules and laws governing wetlands impacts and must obtain a permit from the Army Corps of Engineers and/or Ohio EPA.

"For every acre of wetlands lost, at

Wildlife refuge, wetlands mitigation bank . . . or both? The Ohio Wetlands Foundation has restored 450 acres of wetlands throughout the state.

least 1½ acres of mitigation land must be purchased. After approval from the Army Corps of Engineers and the Ohio Environmental Protection Agency, the applicant can purchase the appropriate number of acres at a wetlands mitigation site," said Vince Messerly, the general manager of the foundation.

The 33-acre Hebron Wetlands Mitigation Bank was the Ohio Wetlands Foundation's first mitigation site. Completed and sold out by May of 1994, it is a remarkable success.

In addition to the Hebron site, the foundation has developed and sold all of the credits in two other banks—Big Island and Sandy Ridge. In all, about 450 acres of wetlands restoration has been achieved at Hebron, Big Island and Sandy Ridge. Credits are now available at three additional banks: Slate Run, Three Eagles and Trumbull Creek. The Trumbull Creek Wildlife Area, the foundation's sixth wetlands mitigation bank, is a 462-acre former farm site that has been relatively dormant for several years. The foundation plans to transform it into an area containing restored forested wetlands and large open marsh wetlands.

"Mitigation banking is a win-win situation," said Messerly. "The environment wins because the mitigation results in the restoration of large, high-quality functional and professionally managed wetlands ecosystems.

The public wins because these mitigation sites are open for recreation and educational opportunities. People can appreciate wetlands, photograph nature, watch birds, and in some cases, hunt and fish on the property. And developers are winners because they have the opportunity for cost-effective, compensatory mitigation and their dollars are providing high-quality wetlands ecosystems."

The Connecticut State

Enacted in 1998, Connecticut's open space legislation has the ambitious goal of setting aside open space equal to 21 percent of the state's total area. To achieve this goal, the legislation established the Natural Heritage, Open Space and Watershed Land Acquisition Program, which identifies and sets aside land for preservation. The centerpiece for that program is the Connecticut Open Space Review Board, which consists of a cross section of public, environmental, civic and industry trade groups, including the Home Builders Association (HBA) of Connecticut.

While supportive of the concept of preserving open space, the HBA of Connecticut wanted to make sure that open space acquisition was not used to block development. One of the key provisions of Connecticut's plan is that state open space funds cannot be used to condemn property. There must be a willing seller. To further ensure that the

Open Space Preservation Plan

program would not be used to block development, Bill Ethier, the Executive Vice President of the HBA of Connecticut, and Tom Francoline, a developer and planner appointed to the Open Space Review Board to represent the association, worked with the other board members to create a property review formula that gives sites with natural resource conservation and recreational value the highest consideration. "If you have a rare swamp, it gets high priority. If you have a piece of land that has nothing special but is in the path of development, the priority is not as high as the swamp," Francoline said.

The open space plan also takes into account areas of a village or town that are important to the character of the area. "If there are tracts of land that residents have deemed important, this plan forces planners in those towns to take that into consideration," Francoline said.

One of the key goals of builders was to inject certainty and predictability into the Connecticut open space land purchase pipeline by forcing communities to decide just how important land preservation was to them. "With the system Bill [Ethier] and I envisioned, we can find out the sites that conservationists and towns want to preserve. Then we can tell the developers, `go there at your own risk'. If the developer goes to a place that conservationists have not identified, then he or she ought to be able to go forward with development plans with fewer problems."

The idea of certainty has been firmly established because the Open Space Review Board is not just a screening process but a land designator that builders trust. "I get a lot of calls from developers asking me `Is this on the map?'," Francoline said.

The success of the original program helped to launch another program in 2000 known as the Charter Oak Open Space Trust. That trust, established to protect watersheds and passive open space, was funded with an additional $12 million per year. Together, these efforts now earmark more than $20 million annually in state funding to protect open space.

How did the Connecticut Department of Environmental Protection and the builders come up with an open space preservation plan that allows development and protects Connecticut land? Francoline thinks it happened because the two groups are "conservationists from different occupations concerned with saving the true value of Connecticut's open spaces."

Few people realize that although it is one of the most densely populated states, Connecticut's developed land amounts to only 8 percent of the state's land mass, according to recent U.S. Department of Agriculture figures. Open space preservation is important, and doing it right is no easy task. Nonetheless, Francoline and Ethier are urging builders in other areas to get involved and shape open space preservation plans in other states. "We tell people to get involved and do something constructive. "If it can work in Connecticut, it can work elsewhere," Ethier said.

Mitigation banking allows needed development while restoring wetlands.

The Alabama QCIP for Residential Construction Storm Water Management Education Program

Federal Environmental Protection Agency (EPA) rules allow states to administer storm water regulations on construction sites in order to reduce runoff and protect water quality. In 1997, the State of Alabama changed its approach to include monthly inspections of storm water control measures, known as Best Management Practices (BMPs).

Initially, builders and developers had to pay to have a Qualified Credentialed Professional (QCP) such as a professional engineer recognized by the Alabama Department of Environmental Management (ADEM) as having expertise in storm water management do site inspections monthly or whenever there was 3/4 inch of rain within a 24-hour period. In addition to these QCP inspections, the state agency conducted its own inspections.

Unfortunately, this approach was flawed, according to Russell Davis, executive vice president of the Home Builders Association of Alabama (HBAA). Because the QCP was not accountable, the builder or developer was responsible if something was wrong and corrective measures had to be implemented.

"For the builder, there was a manpower problem and a legal problem," Davis said. "Builders sometimes ended up having to go out there themselves if the QCPs didn't do their jobs. If the builders didn't go out there and fix it, they were liable. The only remedy for the builder was civil court. In the meantime, the builder was not in compliance with the permit because the QCP did not do the inspections."

As the association investigated further, what it found was "a lack of communication between the QCP and the builder because of the way the program was structured," Davis says. "The way the permit program was set up, the builder couldn't take an active role. Instead, the builder had to rely on the inspector's opinions and expertise. Basically, builders had none of the authority to determine what measures were necessary, but all of the liability if the measures failed or were inadequate."

In 1997, builders and staff from HBAA met with ADEM and initiated discussions about better ways to meet everyone's objectives. The solution was an education program put together by an engineering firm, CH2M-Hill, that teaches builders and developers their responsibilities as well as the practical aspects of installing BMPs and provides them with a state accreditation known as a Qualified Credited Inspection Professional (QCIP). After completing the course, builders are qualified to

determine BMPs for storm water management.

"Having a professional engineer teach the class gives builders the opportunity to not only learn why they must do the right thing, but how they can do the right thing," Davis said. "Once builders complete the program they find out something that can come as a shock: it isn't necessary to spend an exorbitant sum of money on storm water management. They learn there are easier ways that are less expensive, but just as effective."

Alabama builders were successful in having the regulatory agencies accept their program because of two important concepts: responsible protection and on-site environmentalism.

"We found that the person who is liable for storm water violations is much more likely to do a good inspection than someone who isn't liable for it," said Jason Reid, Regulatory Affairs Director with HBAA. It was this argument that won the day. "The responsibilities of a QCP have not changed," Reid explained. "Builders still can be inspected and fined. What has changed is the education and awareness level of our members. The course gives them a better understanding of which BMPs will work and which ones will not work. They now have a working knowledge so that they can conduct monthly inspections, and the ability to do the maintenance to keep their BMPs operational."

The old adage that an ounce of prevention is worth a pound of cure also comes into play. "If someone working on site sees a problem, they are likely to fix it quickly," Reid added. "That way, the ADEM doesn't have to worry about a storm water catastrophe. What's more, ADEM is still calling the shots, and state agency inspections are still there."

The QCIP for Residential Construction has been so successful that ADEM and HBAA are at work launching two new programs with a similar focus: a QCIP course geared toward educating utility companies, and a QCIP program for road-building.

The education collaboration between the Home Builders' Association of Alabama and ADEM, and the course—officially known as the Construction Stormwater Qualified Credentialed Inspector Training Program—has been recognized nationally by some of the nation's leading environmental protection professionals. The Environmental Council of the States (ECOS), a group of state environmental directors and commissioners from around the country, included the program in their 2001 National Compendium of State Innovations publication.

More importantly, since the Qualified Credentialed Inspection Professional (QCIP) program was started in 1999, more than 400 individuals have taken the class and no sites subsequently inspected by the state have been cited for significant storm water management violations.

These wetlands were restored by the Ohio Wetlands Foundation, a builder-initiated effort that is one of the first mitigation banks in the country.

The Future Of Green Building: The PATH Initiative

By 2025, it is possible that houses will be net energy producers, rather than consumers as they are today. The residential building industry has greatly improved the energy efficiency of its products and systems since the energy crisis of the mid-1970s. Insulation levels have increased, windows have double glazing and/or low emissivity films as standard practice, doors are often insulated in the factory, and efficiency of air conditioning and heating equipment has improved dramatically. A typical house built today is considerably more "green" than the most energy efficient houses of a decade ago. The house of 2025 could push these trends further and perhaps even to the point that new homes will become energy self-sufficient or "zero energy" houses.

Wonderland Hill's Harmony Village, Golden, Colo.

Of course, green building is more than just energy efficiency; it also incorporates resource efficiency and environmental stewardship. Builders are learning to reduce and reuse job site scrap and waste, to recycle building materials from houses and other buildings that are being decommissioned, to design and build an advanced energy- and environmentally-efficient building, to use building products containing post-consumer recycled materials, and to take advantage of solar technologies.

To further this important effort, NAHB and the NAHB Research Center are extensively involved in PATH, the Partnership for Advancing Technology in Housing program, which is funded by the U.S. Department of Housing and Urban Development (HUD). PATH is an industry/government partnership designed to achieve dramatic improvements in housing performance, while maintaining housing affordability. The PATH program goals focus on improving durability, energy efficiency, environmental performance, construction safety and disaster resistance of our nation's housing.

PATH is investing in the development of a wide range of technology options to help the housing industry achieve its goals. PATH is working to improve the quality and efficiency of the house framing process, and is currently conducting field evaluations and demonstrations of over 40 innovative building technologies in 15 states. The results of these technical evaluations will be communicated to the building industry through the NAHB Research Center's ToolBase program. ToolBase reaches the building industry through a toll-free hotline (800-898-2842), a technical newsletter called ToolBase News, and through an internet newsletter called ToolBase E-News.

Some of the technologies currently under development include:

Northfield at Fisher's Landing, Vancouver, Wash.

- Electro-chromic and thermo-chromic windows.
- Innovative structural materials for roof, wall, floor and foundation construction.
- Photovoltaics, micro-turbines and fuel cells for generating energy.
- Energy- and water-conserving appliances (washer/dryer combinations, convective ovens, tankless water heaters, greywater and rainwater irrigation systems and recycled products).
- High-tech insulation (like vacuum insulation technology) and other energy-conserving technologies.
- Advanced tools and techniques for increasing labor efficiency.
- Factory-built components or housing systems.

Outwardly, the houses of 2025 may look like houses of today, but they will not perform the same. Not only will houses continue to provide comfort and secure shelter and privacy, they will also serve as a centralized hub for organizing continuing education, health maintenance, fitness, communications, entertainment, and work productivity. In addition to these added features, houses will perform better. They will be more durable and require less maintenance and repair. Water and energy efficiency will be optimized through the use of sophisticated controls. In fact, houses are expected to be able to diagnose their own product and system failures prior to a breakdown and alert service professionals to schedule timely preventative repairs. Many of these repairs to appliances and other computerized equipment will be performed remotely through the Internet, and the owner will not even be aware that a repair has been made.

The house of 2025 should be a net energy producer, not a consumer. Through the use of advanced conservation techniques and energy efficient appliances, the building's energy use will be kept to a minimum, while photovoltaic roofing, fuel cells and micro turbines will supply power to the house and produce excess for sale to utility companies.

The way homes are constructed will also change significantly over the next two decades. These changes will be necessary to deal not only with environmental concerns, but also with issues such as labor shortages. Industrialized housing and components will become even more commonplace, and technical innovations will allow construction that uses only the materials necessary, without the waste often seen on construction sites.

With concerns over water and wastewater throughout the country and the world, expect homes to use less water in the future and to virtually eliminate the need for major waste water treatment plants. Homes will recycle water back through the home for multiple uses. In fact, waste water treatment systems can already produce effluent that is drinking water quality.

Finally, perhaps the greatest environmental impact we can expect from our homes is that they can serve as more than just a home. The information explosion will continue to have a significant impact on key environmental issues. In addition to the self-generation of cleaner fuels and better controls over the use of water and energy, transportation habits will change dramatically for many people. The home office will be indistinguishable from the work environment in many sectors of the economy. The need to travel and to commute will be reduced significantly for many of us too. E-commerce will create a better environment when we can use our home to place orders instead of going out, or when our smart homes can arrange deliveries so that delivery companies can reduce needless trips.

Summer's Walk at Fisher's Landing, Vancouver, Wash.

About NAHB

The National Association of Home Builders is a Washington-based trade association representing more than 205,000 members involved in home building, remodeling, multifamily construction, property management, subcontracting, design, housing finance, building product manufacturing and other aspects of residential and light commercial construction. Known as "the voice of the housing industry," NAHB is affiliated with more than 800 state and local home builders associations around the country. NAHB's builder members will construct about 80 percent of the more than 1.6 million new housing units projected for 2003, making housing one of the largest and most powerful engines of economic growth in the country.

About the NAHB Research Center

The NAHB Research Center is the research and development leader in the home building industry. Federal, state and local government agencies, manufacturers, builders and remodelers rely on the expertise and objectivity that are at the very heart of the Research Center. Uniquely positioned to facilitate invaluable liaisons—between builders and manufacturers, design professionals and housing researchers, and government and industry—the Research Center is dedicated to advancing housing technology and enhancing housing affordability for the benefit of all Americans.

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