5 Green Buildings
for Global Sustainability

"The aim of sustainable design is to support contemporary needs without compromising resources for the future."

- Nancy Rottle, American Society of Landscape Architects

If you have chosen to build on the waterfront, your investment will be first in line for risks from rising sea levels. The mainstream scientific community now accepts the reality of sea levels on the rise across the planet from global warming. In our region, the Chesapeake Bay watershed, sea levels have already increased a foot in the last 100 years, swamping islands and eating up prime shore property; with an expected increase to at least two more feet by 2100 (University of Maryland).

To help keep your site from disappearing under water in coming decades and help prevent other predicted disasters, consider being part of the solution. "Green buildings" use technologies that, among other environmentally sustainable approaches, reduce greenhouse gases associated with global warming by improving

Old Dominion University built Virginia's first LEED (Leadership in Energy and Environmental Design) certified higher education building, housing Engineering and Computational Sciences. The building maximizes natural daylight. Office lights turn on and off by motion sensors.

energy efficiency. Another "win-win" benefit: your utility bills also go down. EPA has a number of programs that provide resources where you can learn more about the components of green building and how to incorporate green building concepts into different types of buildings. Green building information is available at **www.epa.gov/greenbuilding.**

ENERGY EFFICIENCY: FOR BIG SAVINGS

Phoebe Crisman, our advisor at the University of Virginia School of Architecture, tells us the one area where building owners spend money most needlessly involves energy efficiency. "This is usually because inefficient, ineffective heating, cooling and lighting systems are less expensive in up-front costs and engineering," says Crisman. But over the life cycle of the building, "enormous amounts of energy and sums of cash are used up" by these inefficient decisions, she says. For example, providing windows to give workers the benefit of daylight is more expensive up front than fluorescent lights, but the windows will more than pay for themselves. Crisman has won numerous awards for her work at the university and with building design to incorporate sustainable principles. She and Michael Petrus, her partner in the architectural firm of Crisman + Petrus in Charlottesville, Virginia, served as our technical advisors for guidance provided in this chapter.

In 2007, **Earl Industries** began final design of a "green" office building on the Scotts Creek tributary to the Elizabeth River. The Model Level River Star plans to construct the largest green roof (see stormwater chapter) in the Norfolk area, 9,100 square feet, to absorb runoff from this building.

The new office will also feature a series of sustainable practices to conserve energy and water, including glazed, double paned glass, integrated roller window shades, zero to low VOC paints, waterless urinals, low-flow toilets and automated faucet controls.

Elevators will be energy efficient through electric traction. Parking lots will feature rain gardens. Wetlands plantings will be incorporated into the stormwater retention basin.

Building Placement: Work with Sun and Wind to Cool Your Building.

- To reduce cooling costs, place your building to avoid exposure to the hot mid-afternoon sun. The long direction of the building should be east-west, tipped 10 to 12 degrees east to avoid overheating in the afternoon.

- Orient the building to allow breezes to flow through the building during temperate months. Check NOAA data to show the direction of prevailing winds by month.

DESIGN AS A "SYSTEM" AND REDUCE OVERALL COSTS

The least cost-effective approach to designing a green building is to pick a few well-meaning, energy efficient features simply because they fit a line-item budget. More effective for your wallet will be designing the building as an integrated system of features that work together to optimize energy and water use, yet provide a comfortable, well-lit environment for a company to operate.

Here's an example. Designed as a system, a green building may include high performance, operable windows that are more expensive than ordinary units. Yet the building may be less expensive overall because these windows make possible the use of lower capacity heating and cooling units and reduce costs of energy to run them. Similarly, a green roof (covered with living plants to absorb runoff; see chapter on stormwater) is more expensive to install than an ordinary roof. However, the green roof reduces or eliminates the costs of stormwater systems and provides insulation to reduce energy costs.

Earl Industries plans a "green building" complete with a large green roof as its new headquaters on the Elizabeth River (see Chapter 3 regarding green roofs). Green roofs are planted in vegetation to absorb runoff while reducing energy costs and lengthening the life of the roof.

The U.S. Green Building Council has established a relatively easy way for building owners to understand and control the process of constructing a green building. The LEED rating system (Leadership in Energy and Environmental Design), provides a checklist-based tool for evaluating whole building environmental performance over a building life cycle. It provides an owner with a menu of choices of how green to make a building, from bronze (basic), to silver (moderate) and platinum. Achieving a silver rating involves costs similar to conventional building. Meeting platinum standards involves using technologies beyond ordinary construction, such as solar panels, but is cost-effective over the building life cycle.

EarthCraft House provides guidelines for constructing energy efficient, earth friendly housing (both single family and multiple family) specifically applicable to our climate. However, many of these guidelines are applicable to any construction project. They also give one-day training for builders interested in learning more about earth friendly construction. Technical guidelines and information on training sessions can be found on the EarthCraft of Virginia web site **http://www.earthcrafthouseva-sf.org/index.html**. Habitat for Humanity is committed to using EarthCraft construction practices. South Hampton Roads Habitat for Humanities Virginia Beach Covenant built the first EarthCraft certified house in Virginia in the Spring 2007.

MAKE SUSTAINABLE BUILDING MATERIAL CHOICES

For true global sustainability, every material that is brought to a building site should be considered in larger terms. Is it toxic? Were toxins made in its production? What happens to it when we're finished with it?

Toxic end products versus toxic by-products. While many building materials are relatively safe or inert in their final state, the making of those materials at a factory may involve the production of dangerous by-products. Choosing materials that are ecologically safe in their production leads to sustainable building at a global level.

Ecological footprint, embodied energy, or what does it cost our planet to build a new warehouse? Although that sounds like a daunting question, thinking simply and intelligently about the source of each material that goes into a building goes a long way towards minimizing the impact of construction at both local and global levels. When you order building materials, such as plywood, think about how much energy is expended for plywood to arrive at your site. How much oil does it take for plywood to arrive from foreign countries versus South Carolina? Plywood from foreign countries might be less expensive to you, but it has cost the planet more in terms of green house gas from burning fossil fuel. Also consider the effects of your new building on how land is treated far away from your site. How much mining goes into your building or does your wood come from new growth or old growth forests? Substituting fly ash for newly mined materials for concrete, for example, has become a popular and inexpensive practice, while demand for new-growth forest lumber has become the norm. Green construction practices are catching on as conscientious builders force the marketplace to supply sensible materials.

SUSTAINABLE BUILDING MATERIALS

Thinking from the ground up, the following building materials are inexpensive or no-cost, easily available alternatives to conventional, less sustainable materials. Where additional costs are involved, payback times are very short – eight years or less.

Foundation. Concrete: The substitution of fly ash for 20 to 35 percent of Portland ready-mixed cement has become a common practice in the past few years. The environmental advantages of using this byproduct of coal combustion are diversion of materials from the waste stream and reduction of virgin, mined material. Fly ash also offers the benefit of improved concrete performance. A longer discussion of this topic can be found at: **http://www.greenbuilder.com/sourcebook/Flyash.html**.

Concrete Formwork. Two possibilities that reduce waste and improve insulating performance are wall-form materials made from expanded polystyrene (EPS) that remain in place after the foundation is poured and re-useable rubber formwork. Both of these offer the advantage of eliminating waste disposal of plywood formwork. The insulative value of the wall-form materials will also augment energy use over the life of the building and easily pay for itself.

As with all building products, a powerful ecological benefit can be realized by making sure that wood products are sourced as close to the building site as possible. Buying trusses from a local supplier who also receives his materials locally avoids the environmental impact of burning fossil fuels in long-distance shipping. However, it is worth making sure that your supplier is using locally grown resources.

Many pressure treated lumber products used over the past decades have proved to be highly toxic, both in their production and on site. Chromated copper arsenate (CCA) has been used extensively in this country as a wood preservative. CCA is composed of copper, which acts as a fungicide; arsenate, a form of arsenic, which is an insecticide; and chromium, which binds the ingredients to the wood. These toxins and endocrine disruptors are particularly dangerous to children and those who spend more time on the ground. These chemicals are leached into the ground, particularly by sawdust generated during construction.

Alternatives to CCA treated lumber include:

- Plastic “lumber” made from recycled products. Plastic lumber, which is most frequently composed of high density polyethylene (HDPE), does not release hazardous materials into the ground. An additional benefit of using this material is that it is often manufactured with recycled plastic. Therefore, using plastic lumber conserves natural resources. In addition, plastic lumber usually requires less maintenance.

- Composite lumber is wood and plastic combined into one lumber product. Wood-plastic composites generally exhibit low moisture absorption and high resistance to decay, insect, and UV ray damage. The wood component provides the composite with greater dimensional stability than plastic lumber, but not as much as wooden lumber. Like plastic-only lumber, wood/plastic composite lumber is often made with recycled materials.

- Lumber pressure-treated with non-arsenic wood preservatives is available in the marketplace. Many of these wood preservatives are copper-based such as ACQ compound (ammoniacal copper quaternary) or CA (copper azole). A simpler process uses Borates to treat lumber.

Insulation. Insulation materials play a primary role in achieving high energy efficiencies in buildings. There has been concern over the health impacts of the material constituents of insulation ever since the problems associated with asbestos became apparent, followed by the banning of urea formaldehyde based insulation.

Cellulose insulation is made from recycled newsprint. A large amount of newpaper is diverted from a landfill by using cellulose insulation to insulate a home. The

amount of energy needed to produce cellulose insulation is many times less than required for fiberglass or rock wool insulation. Many report (e.g., **www.greenbuilder.com**) that cellulose insulation contains printers' inks, which can possibly outgas formaldehyde into a home. Greenbuilder.com states that if there is any release of gas from inks, it should fall well below levels irritating most people.

However, an environmentally-sensitive person should be careful in selecting cellulose and install a vapor retarder between the insulation and the living space. (Note that the vapor retarder can exacerbate mildew problems if humidity levels in the house are high.) Homepower.com reports that most researchers have concluded that cellulose insulation does not pose a health risk to the occupants of a home **(http://www.homepower.com/view/?file=HP111_pg44_Anderson)**

Rigid board insulations employed as sheathing on homes have played an important role in achieving high R-values. However, the use of CFCs in many of these materials has caused increased release of chlorine molecules into the atmosphere, contributing to ozone depletion. HCFCs outgas a lesser amount of chlorine molecules, however the severity of the ozone depletion situation has led to the recommendation to avoid both types of insulation blowing agent. Alternatives in rigid board insulation are available that do not use CFCs.

Cementitious insulation material is a cement-based foam used as sprayed-foam or foamed-in-placed insulation. One type of cementitious, spray-foam insulation is known as Air-Krete. It contains magnesium silicate and has an R-value of about 3.9 per inch. With an initial consistency similar to shaving cream, Air-Krete is pumped into closed cavities. After curing, it's similar to a thick pudding. Cementitious foam costs about as much as polyurethane foam. It's also nontoxic and nonflammable. Cementitious foam is made from minerals (like magnesium oxide) extracted from seawater. (See **http://www.eere.energy.gov/consumer/your_home/insulation_airsealing/index.cfm/mytopic=11510**). This type of insulation is considered very benign from an indoor air quality standpoint.

Perlite insulation is in a loose form suitable to fill the cavities in building block. Perlite can be bound into other materials and used in sheet form. It is commonly used in commercial roofing material and can be used as an aggregate in concrete. It is non-flammable, lightweight and chemically inert.

Although rockwool insulation is considered an old-fashioned alternative, it is worth including in this list. Rockwool is recycled steel slag (a landfill/waste material). It is available as blow-on wall insulation (a starch binder is used) and as loose blow-in attic insulation. It offers very good energy performance, will not burn, and is chemically inert.

Decking and sheathing. While you might imagine that there might be plywood made from recycled wood products, there are none in the marketplace. There are plywoods made with bamboo, a more renewable resource than pine, although it tends to be a finish grade rather than sheathing grade. There are also plywoods made with non-formaldehyde based glues, but at the moment are difficult to find. This will change in the future, but the moment, the best sustainable plywood and sheathing practice is to be sure that your sheathing is manufactured from locally sourced wood. If your supplier is unsure of the plywood's origin, see if it has an APA (American Plywood Association) stamp. All APA rated plywood is manufactured in the United States and can be traced by codes in the stamp.

Exterior finish materials. For industrial or commercial buildings, concrete planks are hard to beat for economy and ecological sustainability. Steel siding possesses a high rate of embodied energy and requires repainting which has ecological problems of its own. Terra cotta plank systems are becoming more popular for commercial buildings, and have fairly low embodied energy, although they are fairly expensive compared to concrete.

In residential construction, an example of the building industry gravitating toward sustainable materials is the use of cementitious siding, one of the most ecologically sustaining siding materials available today. It also happens to be very economical and low-

maintenance. While vinyl, steel and aluminum siding are terrible for the environment due to mining or toxins released in production, cementitious siding production is non-toxic and has a low non-renewable resource impact. Although it is sourced from some non-renewable materials (sand, cement), its life span is much greater than renewable siding materials such as wood.

Roofing. Whether the roof material chosen is asphalt, rubber, wood, plastic (shingles), clay tile or slate, the lightest possible color should be chosen for two related reasons. Dark roofs absorb solar radiation and heat up adjacent interior spaces, increasing air conditioning loads, and act as frying pans that contribute to the urban heat island effect. The heat island effect may not be much at the scale of one house, but when 1,000 house roofs are cooking in the sun, the effect on the local climate is high. Flat-roofed industrial or commercial buildings can also avoid internal solar heating and the urban heat island effect by using white rubber roofs instead of black, or light colored gravel when a ballasted roof is desired.

F**looring.** When carpet is used, ask the same questions as you would about paints: "What toxins are used in manufacture, and what materials are going to off-gas after installation?" Many carpet companies are aware that they need to produce carpets that reduce indoor air pollution, and have adjusted their manufacturing processes to meet this need. Search them out. For wood floors, many sustainable choices are now available at costs competitive with non-sustainable woods. An internet search will turn up countless locally sourced renewable resource woods. One of the most renewable choices is bamboo, purpose-grown and rapidly replenished.

Atlantic Associates installed a green roof on its office building in downtown Norfolk.

Interior finishes. Like carpets, paints and wall coverings can off-gas toxins years after their installation. Safe interior finish materials cost little and manufacturers are aware of the market demand for safer products. It is no longer difficult to find these products. All it takes on the architect's or builder's part is to spend the time researching this aspect of performance, just as they would for durability.

Energy and Equipment choices. Use EnergyStar certified equipment whenever available. The following are also low or no cost alternatives to conventional systems:

- **Heating and cooling**
  - With the rising price of carbon-based fuels, energy use is no longer only an ecological issue but an economic one for building and home owners as well. The way a building is insulated and the combination of insulation and vapor barriers used is very specific to various climates. Great care should be taken to tailor the exterior envelope to the climate. Proper ventilation, by means of fans and vents, should change the air in a building frequently for health reasons.
  - In the case of large volume buildings such as warehouses or manufacturing buildings, much of the building does not really need to be heated at all. It's the people working inside that do. Recent innovations in heating manufacturing buildings include the targeting of populated areas of large volume buildings, where heated or cooled air is directed by ducts or blowers only to where the building is occupied. This is an example of how teamwork on the part of all consultants can provide an optimum level of comfort while making economic and ecological sense.

- Alternative, energy efficient heating and cooling strategies should be explored. These might include heat pumps, thermal floor systems, ground source heating and cooling loops, passive solar gain, or natural ventilation strategies for temperate seasons. None of these systems is expensive, but they need to be thought out with care to be effective.

- **Lighting.** Recently there has been a great deal of media attention on low wattage light bulbs, an important consideration. More importantly, however, daylighting buildings with windows so that no electric lighting is needed during the day can be easily accomplished by careful consideration of window size, placement and orientation to the sun.

- **Kitchen and bathroom fixtures**. The average American home uses 300 to 400 gallons of potable water per day. The largest water savings to which a builder can contribute is in low water usage fixtures, such as 1.5 gallon per flush toilets, are now common and practical, and 2.5 gallon per minute showerheads have become the norm.

- **Water conservation outside the building:** Rain water from roofs can be harvested for the irrigation of plant material in above or below-ground cisterns (see stormwater chapter for these and other stormwater controls).

- **Water Conservation inside the building:**
  - Capture, filter and re-use of water used in manufacturing processes
  - Use low flow (1.5 gal/flush) toilets
  - Include waterless urinals, a proven technology
  - Use infrared sensors at bathroom hand sinks
  - Incorporate composting toilets
  - Explore dry-pipe options for fire protection (sprinkler) systems.

6 Case Study 3

Southern Branch Corridor, Elizabeth River: Seeking Synergy Across Multiple Sites

As The Elizabeth River Project considered possible case studies for this guidebook, we realized that nowhere on our waterfront could we hope to make more of a difference for the environment and the economy than along the Elizabeth's Southern Branch corridor -- a hot-bed of contamination, pending big-dollar cleanup efforts and uncoordinated, often competing redevelopment plans.

Could our "win-win" approach be applied successfully to more than a dozen sites at once, even when the more than 500 acres included the most controversial private redevelopment projects of the day, as well as a heavily-contaminated Superfund cleanup site?

Our answer so far is a qualified yes. The effort focused our attention where it was most needed, resulting in important environmental protection of critical areas of the Elizabeth River. But with multiple developers and interests involved, the work was so resource-intensive that a small non-profit like ours was at times stretched too thin to develop the relationships and the out-of-the-box solutions needed to achieve the other half of win-win: an economic development project that was balanced enough to move forward.

A locality might be in a better position to work with multiple sites in what amounts to forward-thinking land-use planning. We still have hopes that the economic and environmental revitalization potential of this section of the Elizabeth River, some 750 acres of available land with rare deep-water access to a major port, will be more effectively tapped when the cities of Portsmouth and Chesapeake, Virginia, agree to a common plan for marketing available waterfront, with complimentary zoning, land-use planning and environmental standards.

So far our contribution has been a set of guiding principles for the Southern Branch Corridor, agreed on by a stakeholder steering committee; and intensive recommendations for four specific sites there:

Lessons Learned:

1. Stakeholders can set influential guidelines for sustainable redevelopment of an urban waterfront. Developers may find it easier to obtain permits when they are willing to work within these guidelines.

2. Often an urban watershed will offer multiple, nearby sites with similar redevelopment challenges and opportunities. Working on them as a whole offers the best opportunity for win-win.

3. Working with multiple sites at the same time can be unwieldy and resource intensive, diluting the depth of effort that can be devoted to achieve the difficult challenge of win-win.

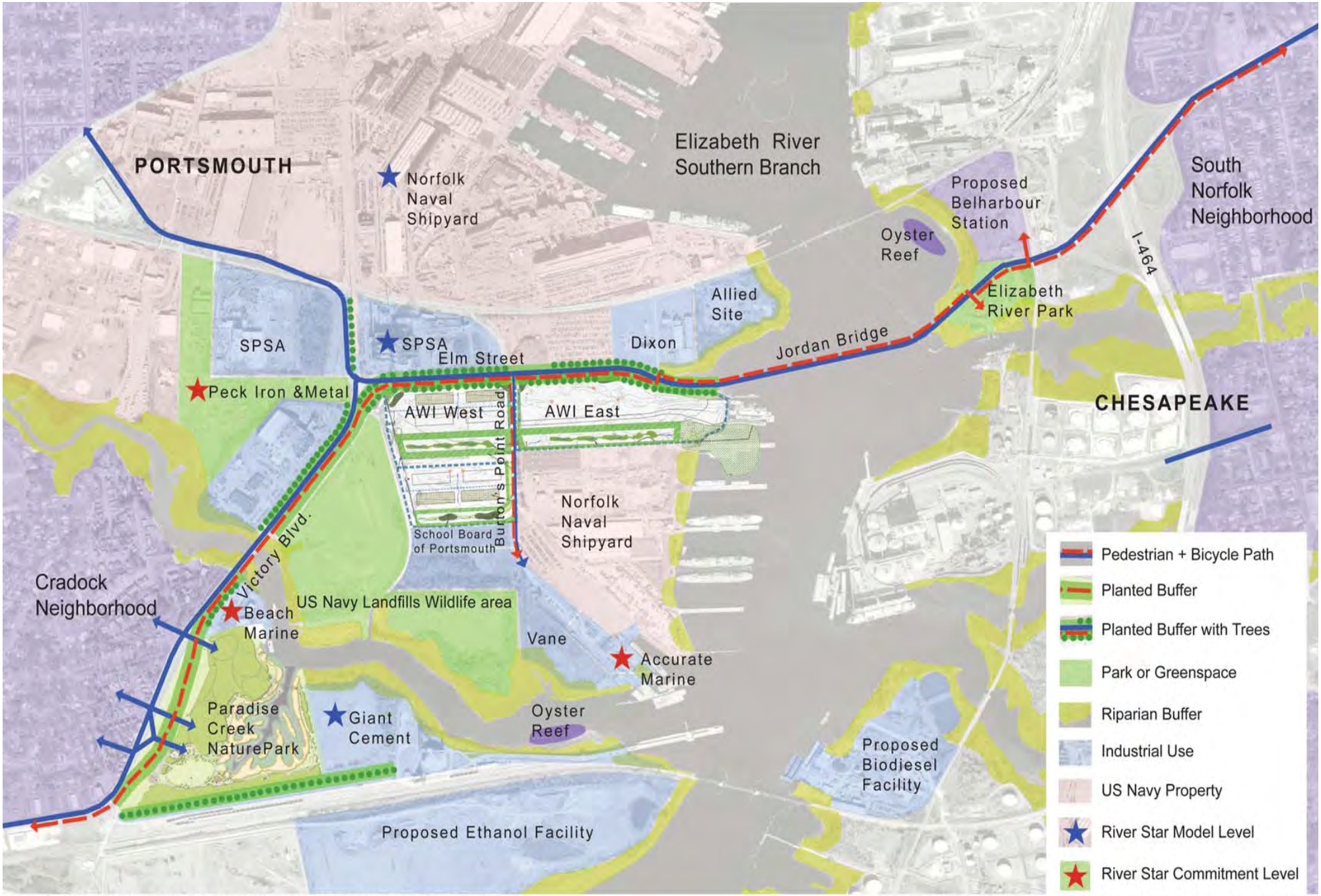
4. Redevelopment opportunities that cross multiple jurisdictions can clash unless a regional approach is found.

- Atlantic Wood, a 48-acre wood treatment facility designated a Superfund cleanup site by the EPA since 1990;

- International Biofuels Virginia's proposal to build one of the world's largest ethanol distilleries on 97 acres less than a mile south of Atlantic Wood;

- Smiling Earth's proposal to build a large biodiesel facility across the river from International Biofuels Virginia (IBE), and

- Belharbour Station, a $200 million condominium development proposed adjacent to the Smiling Earth site.



Conceptual Design Recommendations for the Green Corridor
Prepared for the Elizabeth River Project - Sustainable Development Steering Committee

Crisman+Petrus Architects 8.1.07
Williamsburg Environmental Group

A Steering Committee for the 750-acre Atlantic Wood corridor agreed on general guiding principles including: planting trees along edges of roads, preserving bufers, maximize stormwater and pollution measures, and create a positive merge of environment and industry.

Conceptual Design Recommendations for the Green Corridor
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Suggestions for Atlantic Wood include: redeveloping the Western part of the property as a small industrial park, planting a buffer along the street, and intergrated stormwater practices.

Each developer's responsiveness to the guiding principles proved to be pivotal in determining whether the planned project moved forward or was stalled by public opposition.

STAKEHOLDER GUIDING PRINCIPLES: A PIVOTAL STEP

It's our experience that win-win can be found only when the chief competing interests are at the table to discover it. The Steering Committee for this guidebook, listed in the back of the book, has been our attempt to provide such a win-win forum for sites in the Southern Branch corridor, as well as for proof-testing the guidebook's more general recommendations. The committee included representatives of environmental advocacy groups and developers; economic and environmental protection arms of local governments, as well as our team of technical experts.

The two other case studies in the guidebook, Earl Industries and APM Terminals Virginia, were single sites where The Elizabeth River Project had completed most of its work in seeking win-win with the developers prior to beginning the guidebook. The Southern Branch corridor, in contrast, presented an open book to the Steering Committee with large redevelopment projects still in early formulation.

Over several meetings in 2007, the Steering Committee agreed on general guiding principles it considered appropriate for the redevelopment of all properties in the 750-acre stretch. In addition to the four sites mentioned, other properties included:

- the Dixon property – 11 acres; owner actively pursuing redevelopment;
- the Allied site – 16.5 acres;
- Paradise Creek Nature Park – 40 acres, envisioned as an education center for the win-win principle of marrying industry and environment;
- Peck Iron and Metal – 33 acres, PCB contamination and;
- St. Julian's Creek – 489 acres, Navy site slated for redevelopment.

Nearby facilities not slated for redevelopment but participating in The Elizabeth River Project's River Stars program for industrial stewardship were asked to do their part with achieving the guiding principles for the Southern Branch corridor. These included the Norfolk Naval Shipyard, Giant Cement, RADVA Corp., and Southeastern Public Service Authority's Refuse Derived Fuel Plant.

GUIDING PRINCIPLES – SOUTHERN BRANCH CORRIDOR

- **Plant trees as hedges along edges of roads to provide connected habitat, aesthetics and a screen for industrial activity.** Giant Cement committed to planting native trees such as Eastern Red Cedar and Wax Myrtles along the half mile entrance to the plant; the Naval Shipyard is considering a buffer planted along Elm Avenue; SPSA is considering a significant planting along its Victory Boulevard property; and the proposed IBE ethanol facility proposed to enhance the line of trees between its site and Giant Cement.
- **Protect and enhance 100-foot buffers** of vegetation between development and the river. The IBE facility proposed to conserve its 100-foot buffer.
- **Create a positive merge of environment and industry**. This is the heart of the plan.
- **Maximize stormwater treatment at all sites**
- **Maximize developable property**
- **Maximize cleanup.** Where prior contamination was suspected, The Elizabeth River Project recommended

comprehensive environmental study and maximum cleanup.

- **Adopt aggressive pollution control measures.** The Elizabeth River Project provided extensive recommendations to IBE for controlling pollution at its proposed ethanol facility, anticipated to be a major source of air emissions.
- **Provide an odor free environment.** The Elizabeth River Project also focused on recommendations to IBE for control and objective measurement of odor at the proposed ethanol facility.
- **Improve traffic access.** How to improve access was a topic of much discussion, via the aging Jordon Bridge and bottleneck, narrow roads such as Burton's Point Road.
- **Seek better connection between of the two cities and the neighborhoods.** Bike paths and mass transit were proposed along with improvements or replacement to the Jordan Bridge, an aging, two-lane infrastructure crossing the Elizabeth River between the proposed Belharbour site in Chesapeake and Atlantic Wood/Allied sites in Portsmouth.
- **Minimize footprint on the land.**

The Belharbour Station shore will soon be a living shoreline with wetlands and oysters.

- **Minimize carbon footprint.**
- **Identify all possible incentives.**
- **Consider making this corridor an Enterprise Zone.**
- **Coin an identity for the corridor** – Southern Corridor, Elizabeth River, was suggested.
- **Share consolidated water access ports** – The IBE concept demonstrated this, with plans to share port facilities with adjacent Giant Cement. A similar concept is recommended where possible with other facilities.
- **Consider collective parking and down the road, mass transit.**
- **Use greenways that connect the river to habitat** – This is the key concept developed by the technical team for the Atlantic Wood site.

APPLYING THE PRINCIPLES: BELHARBOUR PROPOSED CONDOMINIUMS

Belharbour Station is a proposed $200 million mixed-use development in the South Norfolk neighborhood of Chesapeake, to include as many as 600 upscale condos and a marina. The previously contaminated site was originally zoned for industrial use. In meetings with The Elizabeth River Project, Truxton Development representatives incorporated several sustainable redevelopment concepts into the plans, including:

- A commitment to incorporate Low Impact Development strategies to treat stormwater runoff close to the source. Bioretention, or rain gardens, were incorporated in the landscape design to augment treatment, allowing for a less extensive, less expensive stormwater pond

- The near-shore edge of the marina was moved further away from the shore into deeper water and boat slip locations were shifted to reduce the amount of dredging required, saving costs and shallow-water habitat.

- A "living shoreline" is planned (see habitat chapter) in the shallow water area to include oyster shells as a berm.

- In the vicinity of an existing oyster reef restored by the Elizabeth River Project in 2004, the developer plans to place pilings at a relatively close spacing to prevent boats from approaching the reef.

- Signage on the pilings and/or the floating dock may also provide an educational opportunity about the living shoreline, oyster reef, etc.

As of the end of 2007, the project has been approved to move forward by the City of Chesapeake, and the environmental clean-up of the development site has begun.

APPLYING THE PRINCIPLES: SMILING EARTH PROPOSED BIODIESEL SITE

A California developer, Smiling Earth Energy, proposed a large biodiesel facility on a 44-acre brownfield site along the Southern Branch, within sight of Atlantic Wood across the river. The $532 million facility would produce 320 million gallons of biodiesel per year, which would make it the largest biodiesel facility in the United States. The Elizabeth River Project offered recommendations for sustainable development. The majority were agreed to verbally by the developer and many were included as stipulations in a conditional use permit granted by the City of Chesapeake.

After meetings with The Elizabeth River Project, the developer agreed to these recommendations:

1. Conduct a detailed assessment of environmental and community impacts of this development, and identify comprehensive measures and objective standards that will be employed to minimize impacts.

2. Reduce encroachment into the Chesapeake Bay buffer. Original development plans included structures, tanks and roads within a few feet of the shore. The developer agreed to pull development out of the immediate shoreline for 50 feet.

3. Delineate and conserve/restore wetlands. After originally finding no wetlands on the site, the developer eventually agreed to place a two-acre wetland site under a long-term conservation easement.

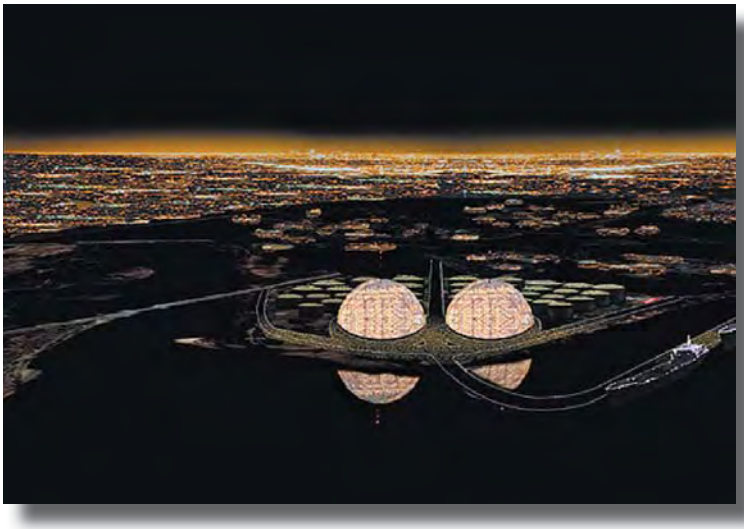
4. Conduct an investigation and, as needed, clean up of likely upland contamination from prior use. The developer completed initial investigations.

5. Minimize impervious surfaces and provide maximum stormwater treatment.

6. Incorporate the highest level of pollution prevention on site.

7. Use native plants in all landscaping.

In October 2007, the project was approved by the City of Chesapeake; however, financing difficulties have precluded moving forward.



Proposed conceptual design of a biodiesel plant.

APPLING THE PRINCIPLES: IBE PROPOSED ETHANOL SITE

In the same vicinity, IBE proposed the largest ethanol facility in the world, a 216 million gallon facility immediately south of Elizabeth River Project's Paradise Creek Nature Park, Giant Cement and the Cradock neighborhood of Portsmouth. Through the summer and fall of 2007, IBE drew headlines and angry crowds at public meetings, from a community fearful of impacts similar to those of an ethanol plant that was shut down in St. Paul for odor, as well as ethanol plants inspiring EPA concerns for air emissions in the early 2000s. Most ethanol facilities have been located in rural areas because of potential impacts on citizens.

The Elizabeth River Project sought to develop recommendations for the developer and City of Chesapeake in keeping with the guiding principles for the Southern Corridor. Additional concerns included the in-direct effect of an anticipated increase in corn farming on the Chesapeake Bay to supply the ethanol facility. Corn farming is a leading source of nitrogen runoff, the No. 1 problem with the health of the bay. In November 2007, the Chesapeake City Council denied a conditional use permit for the facility, citing community concerns to shelve the project.

These were some of The Elizabeth River Project's key recommendations:

1. Prepare a comprehensive analysis of environmental and human health risks for the benefit of decision-makers, at a level of detail that would be required of a project of this magnitude under federal scrutiny.

2. Meet the highest criteria for minimizing air emissions and impacts to human health and the environment, and offset unavoidable impacts. The developer incorporated some state-of-the-art controls into designs but discussions remained unresolved regarding appropriate technologies and emission limits.

3. Maximize stormwater treatment. The developer made a verbal commitment to consider Low Impact Development strategies.

4. Reduce the use of fresh water by planning and re-use of sewage treatment plant effluent. The plant was proposed to use 1.4 million to 2.1 million gallons of fresh water per day, the equivalent of a small city.

5. Guarantee 95 percent-plus efficiency in the control of odor and noise, and bench-test untried technology. Olfactory meters are available that provide objective odor measurement and other localities have developed standards. The Elizabeth River Project recommended modeling of the impact area, daily monitoring and a compliance level of 1 odor unit above ambient conditions. Debate continued over whether an appropriate compliance level and monitoring could be established.

6. Purchase corn only from distributors who require farmers to document recommended conservation practices. Help fund conservation education and cost-share incentives for farmers to get started with these practices. The unprecedented demand for corn as raw material for the ethanol could pose grave risks to the health of the Chesapeake Bay and other waters, unless farm conservation practices are required of suppliers. The Elizabeth River Project recommended that the developer, at a minimum, provide funding to help the bay states pay for incentive programs for farmer to use conservation tillage, winter cover crops, nutrient management and restoration of riparian buffers. The developer responded that these approaches were impractical.

7. Implement additional maximum pollution prevention practices to limit risks of devastation from the spill of large volumes of flammable and or toxic materials, especially during hurricanes.

8. Document financial stability and environmental compliance.

9. Maximize conservation of the shoreline buffer area, incorporate native plants and complement adjacent

public park area. The developer agreed to protect the 100-foot buffer, in one of the more positive environmental approaches at the site.

The City of Chesapeake's Planning Department incorporated some of these recommendations into a long list of proposed stipulations for IBE – more than three times the amount of stipulations ever proposed by the department for a developer. In November 2007, the conditional use permit was denied by City Council due to concerns from the surrounding residential neighborhoods and the adjacent City of Portsmouth on the potential for significant impacts and the uncertainty surrounding the developer's proposals to mitigate those impacts.

APPLYING THE PRINCIPLES: ATLANTIC WOOD SUPERFUND SITE

A small fish, the mummichog, exhibits as much 65 percent pre-cancerous lesions alongside the 48-acre Atlantic Wood Industries facility. Location of a former wood-treatment facility, the site has been listed since 1990 on the EPA's "Superfund" or National Priorities List of the nation's most serious uncontrolled or abandoned hazardous waste sites. From 1926 to 1992, a wood-treating facility operated at the site using both creosote and pentachlorophenol (PCP). The site was contaminated from the treatment operation, storage of treated wood and disposal of wastes. Sediments in the Elizabeth River contain visible creosote.

The ground water and soil at the site are also heavily contaminated with creosote. Creosote contamination previously migrated into a storm sewer and discharged to an inlet of the Elizabeth River at the northeast corner of the site near the Jordan Bridge. Polycyclic aromatic hydrocarbons (PAHs), PCP, dioxins and metals contamination (mainly arsenic, chromium, copper, lead and zinc) have been detected in soils, ground water and sediments. A number of these compounds have also been detected in stormwater runoff from the site. Currently, Atlantic Wood operates a pre-stressed concrete products manufacturing facility at the site.

In 2004, Atlantic Wood, the adjacent Norfolk Naval Shipyard, The Elizabeth River Project and other partners received White House recognition for a breakthrough clean-up of an inland area of the site, resulting in a restored wetland (Coastal America Award). In 2006-2007, the EPA began serious planning for remediation of the off-shore contaminated sediments, resulting in a December 2007 Record of Decision that describes the clean-up actions.

The Steering Committee for the guidebook, with help from the technical team, focused on potential redevelopment of the Atlantic Wood site as a catalyst for sustainable development of neighboring properties. Recommendations included:

Master Plan for Atlantic Wood Redevelopment

- While the Atlantic Wood site is currently zoned for heavy industrial use, the Steering Committee suggested redeveloping the western part of the property as a small industrial park to support the surrounding industries while also promoting the redevelopment of other brownfields in the vicinity of the site.

- A continuous vegetated buffer was suggested along Elm Street (between Jordan Bridge and SPSA conveyor) to provide a physical barrier and to screen the

Atlantic Wood and Norfolk Naval Shipyard restored a toxic dump into a thriving wetland.

Paradise Creek Nature Park will be the 40-acre keystone of the corridor, featuring an education center, mature forest and restored wetlands, as well as permeable paving, "rain gardens," canoe and kayak launch, and over two miles of trails.

Atlantic Wood site consisting of a wax myrtle hedge and American Elms. This buffer would be one of the largest vegetated areas along the corridor and provide more habitat connectivity in the industrialized landscape for wildlife movements. The buffer would not only provide much need habitat to the area but it would reduce traffic speed.

- Provide a continuous sidewalk integrated with stormwater management practices and vegetated buffer along Elm Street and Victory Boulevard from the Jordan Bridge to the Paradise Creek Park. There was some discussion of connecting with the existing sidewalk on the North side of the Jordan Bridge; however there was no consensus that biking across the bridge would be safe.

- Grass pavers or vegetated storage areas for a portion of the materials storage areas at Atlantic Wood (dependant on access, types of materials, loads, etc.) would help to reduce large amounts of stormwater runoff by allowing stormwater to be absorbed by the native soils. Although the remedial options for the site call for a semi permeable cap, these pervious areas could be strategically placed in areas of the site that do not contain high levels of contamination. A plus for reducing impervious areas results in less area needed to treat the stormwater runoff.

- Design infrastructure and parcel dimensions at Atlantic Wood and nearby sites to accommodate light industrial and associated office or storage uses. Encourage tenants to use marine shipping and/or rail and limit heavy truck traffic to reduce air pollution and traffic congestion.

- Recommend green roofs (see stormwater chapter) to significantly reduce stormwater volume and reduce urban heat island effects (when cities produce their own weather because of the amount of heat radiating from the impervious surfaces). Most impervious, or hard, surfaces trap heat and give it off over long periods of time. If green roofs are not determined feasible, then roof rainwater collection systems should be suggested.

- Encourage sustainable building practices (see Green Buildings chapter), such as locating structures to optimize solar orientation, passive ventilation and natural day lighting.

Wetlands as Green Space and Stormwater Treatment

- The Southern Corridor concept includes creating a powerful central green space to provide multiple functions including organizing the future industrial park on the western Atlantic Wood parcel, controlling runoff, and providing a beautiful habitat connection to the river (in alignment with existing Atlantic Wood Industries east tidal wetland). This habitat would support vegetation that is reliant on both fresh and brackish waters. The vegetation in the headwaters would consist mostly of freshwater wetland species. They would filter out stormwater runoff from the site while also providing wading bird and fish habitat. The central design of this wetland and stormwater treatment train would minimize the volume of stormwater ponds needed for the site while providing high quality habitat linked to the river. This wetland would also extend into the eastern portion of the site, and this part of the wetland would feature more tidal vegetation. The design calls for a forebay to collect and hold sediments in the stormwater runoff. The forebay would be placed at a location easily accessible for maintenance. Note that further geotechnical analysis is needed to determine the most functional/ practical treatment method for the “wetland forebay”.

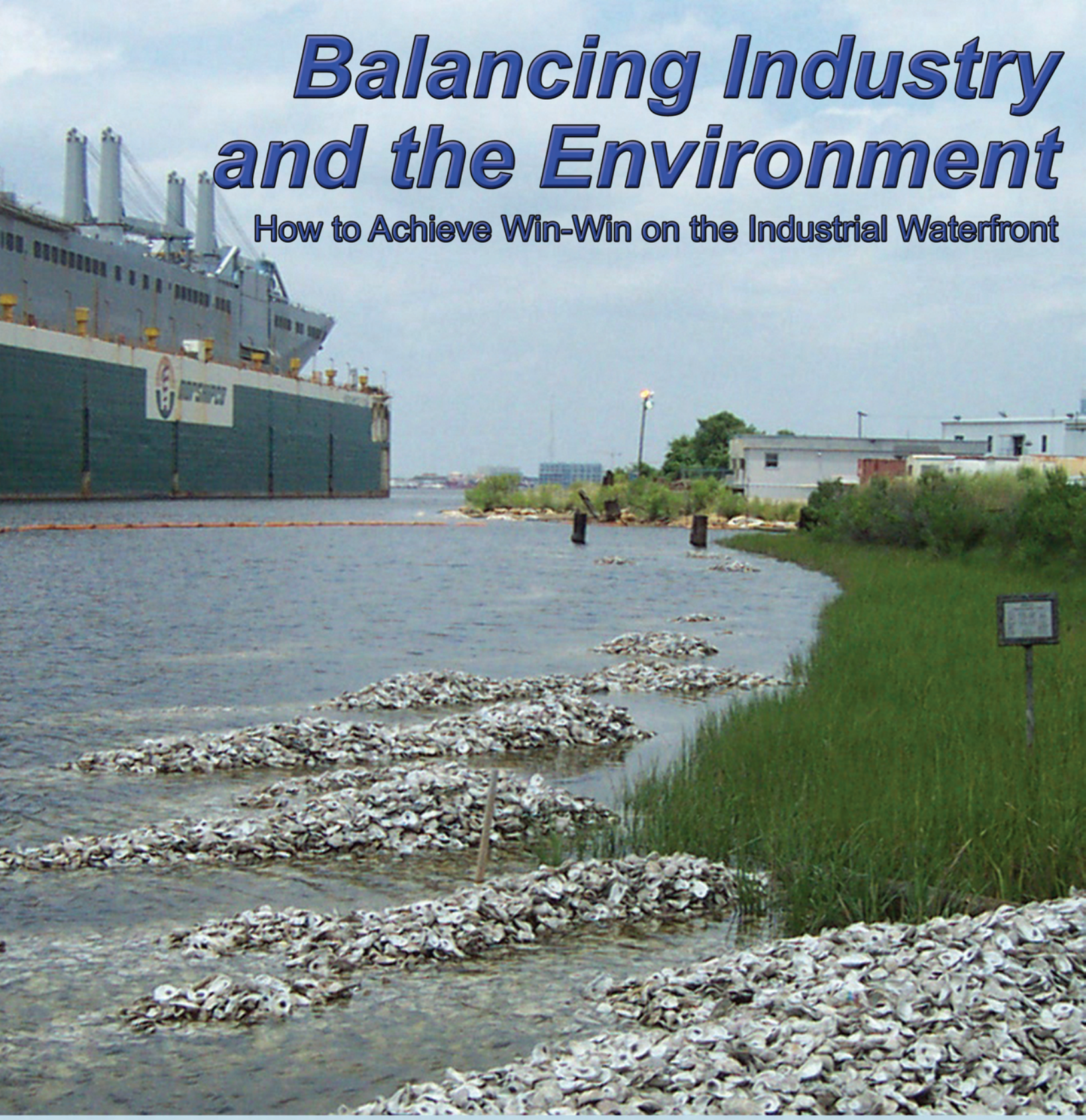
- Connect the central wetland forebay with a network of distributed stormwater practices that work in concert with new access roads. North South swales are suggested to convey water along Burton’s Point Road, along with detention/retention basins collecting water at the North and South edges of the site. If this element is not constructed, the existing wetland may fill in from sediment transport and allow invasion of Phragmites australis, a non native reed grass.

- Observe a minimum 50’ (100’ preferred) building setback along the river and wetland areas. This area provides critical transitional habitat from water to uplands. The trees and bushes in these areas will filter out sediments and contaminates before they enter the river.

- Add native hardwood trees to enhance the eastern area of the Atlantic Wood site, adjacent to the recently restored wetland area (winner, Coastal America award) for at least 50 feet landward to provide a vigorous buffer for the wetland. The buffer would provide a natural limit for site operations to prevent negative impacts on the restored wetland. This buffer would also add a positive aesthetic backdrop for workers. Trees and bushes should be considered that might provide phyto-remediation of PAH contaminated soils. At nearby Hess, poplar trees proved successful with reducing PAH contamination in the soils.

Balancing Industry and the Environment

How to Achieve Win-Win on the Industrial Waterfront



A Guide to Sustainable Redevelopment Practices by The Elizabeth River Project

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Cover photo: BAE Systems Norfolk ship repair (formerly NORSHIPCO) restored wetlands and oyster reefs.

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