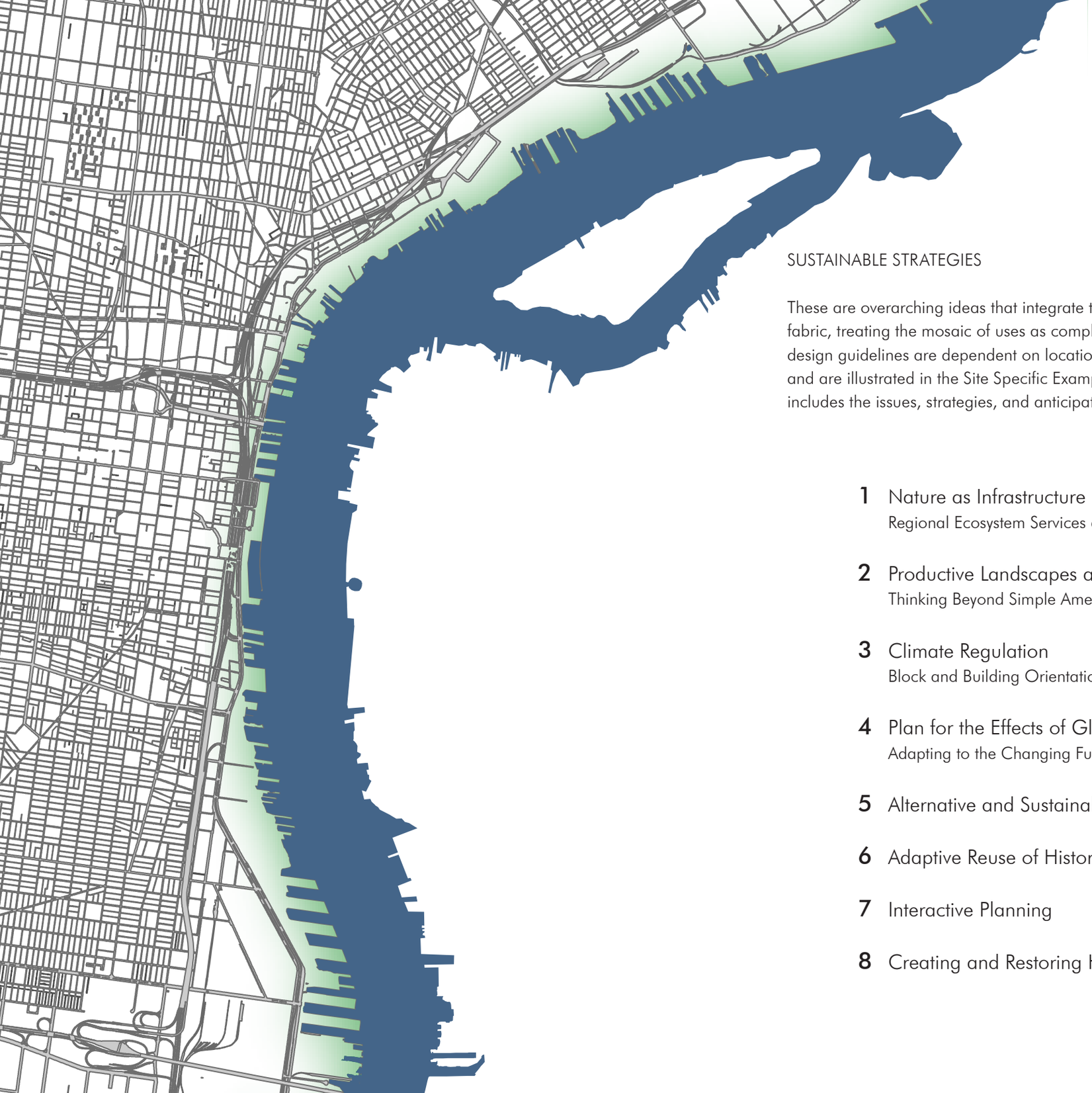


SUSTAINABLE STRATEGIES

These are overarching ideas that integrate the waterfront and its related urban fabric, treating the mosaic of uses as complex interrelated systems. Specific design guidelines are dependent on location, orientation, and opportunity, and are illustrated in the Site Specific Examples section. Each set of guidelines includes the issues, strategies, and anticipated benefits.

1 Nature as Infrastructure
Regional Ecosystem Services and Collective Assets

2 Productive Landscapes and Multiple Scales
Thinking Beyond Simple Amenities

3 Climate Regulation
Block and Building Orientation for the Urban Grid

4 Plan for the Effects of Global Warming
Adapting to the Changing Future

5 Alternative and Sustainable Energy Solutions

6 Adaptive Reuse of Historic Structures and Landscapes

7 Interactive Planning

8 Creating and Restoring Habitat

1 NATURE AS INFRASTRUCTURE

Regional Ecosystem Services & Collective Assets

Issue:

The Delaware Waterfront is more than a river edge. When viewed as a viable, whole entity that functions as an integrated system, the waterfront's value is greater than the sum of its parts. The natural processes of healthy ecosystems are provided at no cost to the benefit of all Philadelphians, and can be an alternative to the hyper-engineered infrastructure that has come to dominate our cities. Ecosystem services include: flood protection, bank stabilization, water and air purification, climate regulation and moderation, carbon sequestration, food and raw material production, waste decomposition, erosion control, biodiversity, genetic resources, and wildlife habitat.

Strategies:

1-A: Think Bio-logically – biomimicry lends ideas for a new infrastructure

- *"3.8 billion years of evolution* [along the Delaware] *has refined what works, what is appropriate and what lasts. Biomimicry is a new way of viewing and valuing nature. It introduces a new era based on not what we can extract from the natural world but what we can learn from it. It then imitates what was learned to create designs which solve human problems."*[6]
- Insights from the study of Delaware Estuary can be employed when developing the Delaware Waterfront.
- Processes can be mimicked in specific engineered solutions or harnessed as part of a larger ecosystem.
- Healthy ecosystems and their services are resilient and able to adapt to change, this is important when planning for climate change.
- Timeframe and lifecycles are important considerations when planning for this type of infrastructure.
- Although current land use practices can alter ecosystem services to the point where they are significantly imperiled, restoration may be possible in the long term.

1-B: Economy of Ecology – the value of ecosystem services

- *"Because so many ecosystem services are provided by the natural world at no apparent cost, humans often under-estimate or ignore their value when making land use decisions"*[7]
- Ecological services provided by wetlands, riparian buffers, urban forests and other BMPs utilizing natural processes can be quantified in monetary terms.
    - *"Valuation is critical to incorporating the importance of ecosystem services into decision making frameworks, which are largely structured in economic terms."*
    - Lack of information on the role and value of biodiversity is a problem when trying to incorporate these services into a market economy.
    - Ecological valuation tends to capture only a marginal part of real value – total value is priceless.
- Quantify infrastructure by revealing economic savings and long-term fiscal benefits of ecological planning.
    - New York City drinking water case study example: Estimated $6 Billion to replace Catskill Watershed services with engineered solution.
    - US Forest Service and UC Davis undertook a study of the value of street trees in New York City in annual energy savings, air quality, stormwater runoff treatment, and real estate sales. The study determined that street trees are collectively worth $122 million a year to the city, with an average of $50 to $300 apiece.[8]

1-C: Collective Assets: The benefit of the commons

- 92 % of Philadelphians believe that environmental and infrastructure improvements are necessary to improve the area's economic competitiveness and growth.[9]
- Open space as a collective asset can actually save municipal money: More than 60 fiscal impact studies indicate that preserving open space is likely to be a less expensive alternative for communities than residential development (which requires costly infrastructure and city services). [10]
- Green infrastructure advertises and pays for itself over time: Increased property values, desirability of neighborhoods, and public health are subsequent gains.
- Set an example for the entire Delaware Watershed. Over time, cities upstream and downstream will follow suit.

What we stand to gain:

When we think of nature as fundamentally no-cost infrastructure, or better yet, infrastructure that gives back, the benefits are staggering. Bio-logical and bio-regional thinking allows Philadelphia to implement solutions that are tailored to this region while positioning this unique city within its larger environmental context.

2 PRODUCTIVE LANDSCAPES AT MULTIPLE SCALES
Thinking Beyond Simple Amenities

Issue:

In order to use natural processes as a significant contributor to our infrastructure, these services need to be applied at multiple scales and incorporated wherever possible. Hence, ecological planning must be a central focus and not at the fringes of the design process.

Strategies:

2-A: To leap forward, look backward
- Solutions for enhancing Delaware waterfront quality are found in what lies behind it: water management starts in the hundreds of micro-sheds within upland Philadelphia. Mitigating stormwater within these sheds will yield compound savings and successes at the Delaware waterfront.
- Promote infiltration, evapotranspiration, and water reuse through BMPs in corresponding sewersheds.
- Strategies for stormwater treatment, energy efficiency, and air quality at the waterfront should be seen as catalysts for incremental greening of upland areas, reaching back into the fabric of Philadelphia.

2-B: Flex Space: public spaces must serve multiple functions
- Rethink the conventional definitions of "park" – parks can include area under freeways, abandoned piers, common back-alleys, etc.
- Consider parks as areas of production, e.g., nurseries for street trees.
- Envision streets as collectively owned open-space with multiple possible uses.
- New streets should be designed in consideration of the overall health and effectiveness of Philadelphia's urban forest.
- Design streets with continuous tree trenches with infiltration capacity and passive aeration and watering pipes.
- In general, broadleaf trees are most effective at sequestering carbon, scrubbing air-pollution, and mitigating stormwater runoff.
- New parking lots should be designed with multiple objectives in mind.
- Parking lot design should include vegetated swales and subsurface water storage.
- Parking lots, new and old, should be designed or retrofitted to provide greater than 50% shading by tree canopy to reduce ambient surface temperatures and heat-island effect.
- Surface parking lots adjacent to waterfront should be seen as opportunities for flexible event space.
- Stadium - in planning large parking lots with intermittent use, permeable "green" solutions such as pervious pavement and stabilized soils.
- Vacant lots and underutilized properties can be managed as open space that supports ecological objectives.
- Open space should create community with nearby neighborhoods. Consider temporary leases for community gardens, local and regional food markets, informal art and performance areas.

2-C: Connective Tissue - Contiguous Open Space engages the bigger picture
- Continuous riparian buffer averaging 100' - 300' wide allows for rich diversity of estuary-based plant and animal communities, while also serving as valuable recreational area for people.
- The variable width of the riparian park allows vital interspersion of micro and macro habitats
- Connected park systems are commonly used by local residents as alternative transportation corridors

2-D: Manage Stormwater ecologically - Design strategies will honor and support the primary ecological resources provided by the river
- Strengthen natural resource connections for all parks and make stormwater management visible – rainwater pools, native vegetation, connected wetland systems, etc.
- Landscape areas need to manage 100% of own stormwater contribution.
- Landscape at waterfront should also manage 100% of stormwater from buildings within riverfront development parcels.

What we stand to gain:

Nature makes the most of every square foot of earth by multi-tasking. To make the most of our valuable public spaces, it is time to rethink Philadelphia's urban landscape as having multiple possible uses. Thinking beyond simple amenities lets us see the value in every inch of real estate, whether that value is in terms of the possible ecological services provided, or in terms of the social value of public open space. Additionally, economic savings compound when land serves multiple functions – no longer merely a sea of asphalt, a parking lot can be a rain garden, a concert venue, a nesting site, and a market all at once. It will take a shift of priorities, but many of the solutions are quite simple, and the rewards of reconnecting to the river will be incalculable.

3 CLIMATE REGULATION

Block and Building Orientation for the Urban Grid

Issue:

The organization of streets, buildings, and open spaces has a huge impact on the sustainability of the Delaware Waterfront. Previous development along the waterfront has overlooked the benefits of urban patterns that emphasize passive design techniques for the surrounding district. When incorporated at the scale of building groups, these strategies are critical to passive design as they have a major impact on reducing or magnifying the heating, cooling, and lighting loads to which individual buildings are subjected. 50% of the energy use in the USA is consumed in the operation of buildings.[11]

Strategies:

3-A: The ideal block orientation in temperate climates is a grid rotated 22.5° off the cardinal directions.[12]

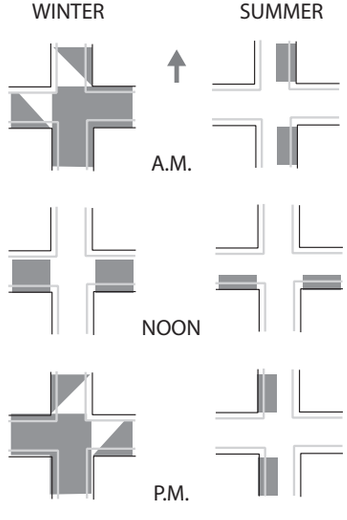
- This orientation maximizes solar gain in winter and shading in summer.
- Extension of the existing Philadelphia grid offers multiple options for grid orientation or building orientation within blocks.
- Plan for wider east-west streets and elongated east-west blocks to maximize solar gain.
- Install development guidelines for allowable solar envelopes of new development - guidelines ensure access to sun for buildings, streets, and open spaces. The size and shape of solar envelopes depends on the site size, orientation, latitude, and time period for desired solar access.
- This has implications for energy use – heating, cooling, daylighting, etc.

3-B: Thermal comfort in open space:

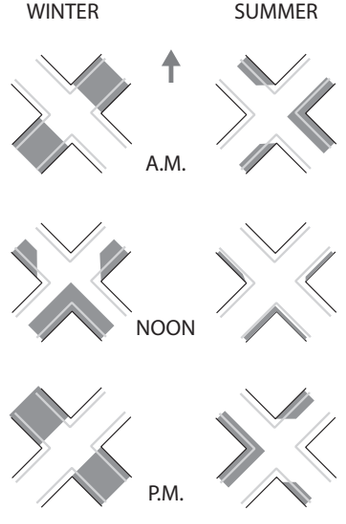
- For summer cooling, streets oriented 20°-30° oblique to summer winds maximizes air flow through an urban area. Buildings spaced close together minimize undesirable winter winds.
- Blocks and building massing can be oriented to take advantage the passive cooling of summer winds coming off the Delaware River, thus decreasing energy loads
- Street grid orientation can help to mitigate the heat island effect in dense cities.

What we stand to gain:

Increased efficiency of an entire district through passive design techniques has a cumulative effect far beyond the savings of individually rated “green buildings.” A vision for a new street grid extending to the waterfront can take advantage of these strategies at both the large scale and the small scale to bring sustainable solutions to all new construction. Once in place, the urban pattern provides the logic for advances in green development at the parcel scale.



Streets bearing east-west are likely to be particularly uncomfortable: dark and cold in winter, bright and hot in summer.



All streets laid out at an on an angle have some winter sun and summer shade, making them generally more comfortable than streets laid out on the U.S. Land Ordinance grid.

4 PLAN FOR THE EFFECTS OF GLOBAL WARMING

Issue:

Of the surrounding area, the urban core of Philadelphia will be the most impacted by the effects of global warming. Rising water levels, increased storm intensity, and increased ambient temperatures will have unprecedented effects, but our ability to plan for these changes can be focused and specific.

Strategies:

4-A: Respect the flood plain
- Do not place major utilities or infrastructure within the 100 year floodplain.
- Where possible, align the boulevard to avoid the floodplain.
- Re-establish flood plain vegetation wherever possible.

4-B: Approach systems thinking at multiple levels
- Small but cumulative strategies can be applied across a large scale.
- Strategies at the parcel scale help developers to reduce risk.
- Strategies at the city scale should be developed for emergency contingencies.

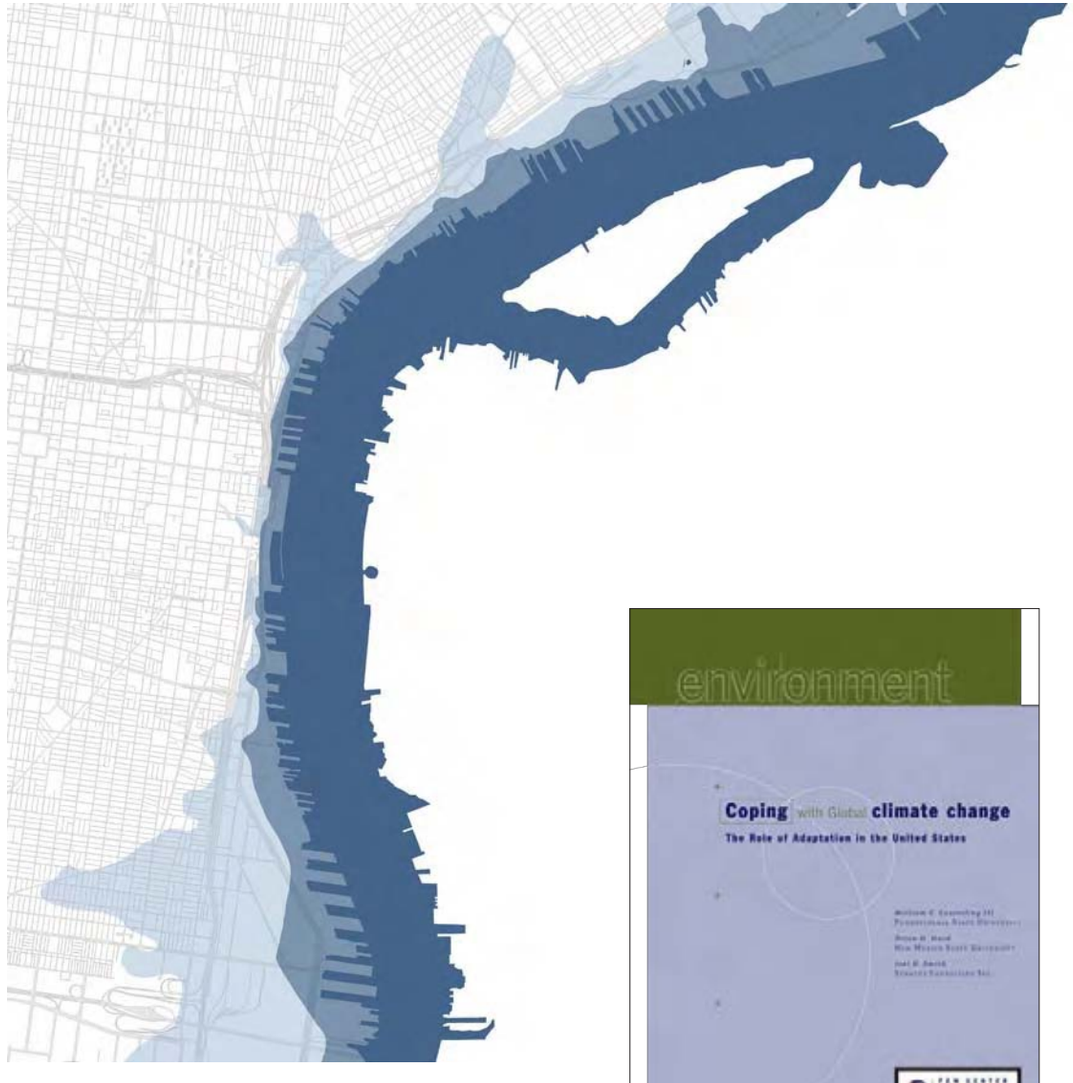
4-C: Causes and effects of global warming are intimately linked –
- Improvements in carbon sequestration can help temper storm events, tidal fluctuation, etc.
- Improvements in air and water quality have beneficial effects on the urban forest, which has reciprocal effects on air and water.

4-D: Retrofit old buildings and infrastructure
- Retrofitting and upgrading old buildings with new energy systems reduces carbon emissions and is cost-effective through energy tax credits and long-term savings

4-E: Invest in biodiversity
- Healthy genetic populations (reproduced sexually) in local communities are suited to local conditions are have the ability to adapt to change and outside stressors (disease, insects…) more readily than monocultures.

What we stand to gain:

Increased awareness of the negative effects of global warming is inspiring change at the level of cities, institutions, and individuals. Combined efforts from the City of Philadelphia, local businesses, and the citizenry helps protect our existing assets and plan for future growth.



http://www.pewclimate.org/

5 ALTERNATIVE AND SUSTAINABLE ENERGY SOLUTIONS

Issue:

Sustainable energy solutions are in high demand as we face high energy prices, dependence on hydrocarbons, and increased pollution. Deregulation of electricity in 2010 is predicted to make Philadelphia's rates among the highest in the nation. The technologies to implement sustainable energy solutions exist today, and are becoming more sophisticated each year. The Delaware Waterfront offers Philadelphia an opportunity to prove that these solutions make ecological and financial sense over the long term.

Strategies:

5-A: Smart Energy Networks and Leapfrogging

- Decentralized power generation reduces the need for hierarchical substations, reduces point source vulnerabilities and allows alternative energy generation to be sold back to the grid.
- Information technology is integrated into the grid which allows for demand response and system reconfiguring automation – networked system allows for real-time monitoring of consumption and pricing. Smart appliances are able to respond to grid signals and power down during peak demand or higher prices, thus averting strain on the system.
- Goal = The creation of profitable, demand-driven renewable electricity markets.
- example: Grid Wise Project – Yakima Washington, Gresham Oregon
- example: Cambodian Renewable Energy Action Plan

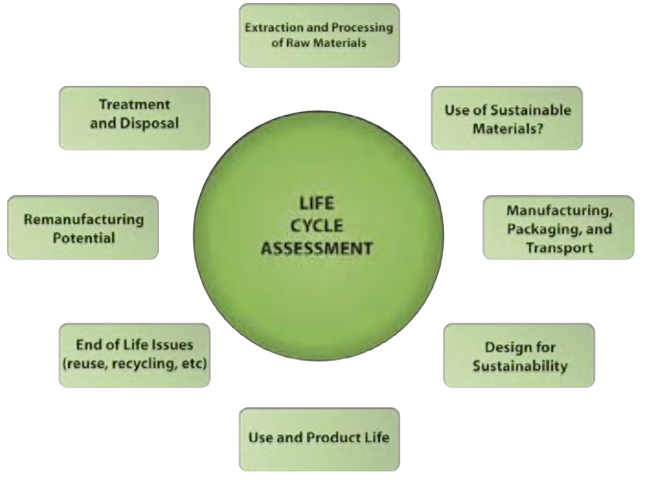
http://www.gridwise.org/

5-B: Alternative energy sources – geothermal, tide, wind, solar – for new and existing industrial and mixed-use development.

- Smaller scale power generation strategies should be scalable.
- Create incentives for alternative energy production.
- Create incentives for commissioning of new construction to monitor/fine-tune the effectiveness of green technology once it has been installed.

5-C: Life-Cycle Assessment for all new construction[13]

- Encourage the use of low embodied-energy materials.
- Encourage the use of locally manufactured materials to reduce wasted energy in transport.
- Encourage the use of durable materials that are recycled and/or recyclable.



What we stand to gain:

New waterfront development is perfectly situated to make use of the Delaware River as an endless source of viable energy. Scalable energy solutions can provide power to individual developments while supporting broad districts. This allows for incremental implementation of development. Risk from point source vulnerabilities overloading is reduced by decentralization and demand response, making the system more secure and reliable. Hand in hand with strategies for energy efficiency, conservation, and passive methods, new technologies will create jobs, investment, and renewed interest in renewable resources.

6 ADAPTIVE REUSE OF HISTORIC STRUCTURES AND LANDSCAPES

Issue:

Historic structures and vacant lots abound on the Delaware Waterfront. In many cases, people do not know about the historic landscape of the waterfront because access is so limited. In addition, many structures have been abandoned and/or vacant for years, and need rehabilitation or renovation before the public is allowed access.

Strategies:

6-A: Identify existing structures with potential for adaptive reuse.

- Incinerator
- Pulaski Park
- ConRail Piers
- Sunken ships at Pier 70
- Vacant piers near Walmart

6-B: Community-building - Historic structures, with or without historic designation, can be potent tools for community-building.

- Examples– McMenamins, Portland OR; Artists and Cities Pittsburg PA; Artspace, Minneapolis MN

www.mcmenamins.com

www.artistsandcities.org

www.artspaceusa.org

6-C: Tax Incentives - Make use of significant local, state, and federal tax incentives for adaptive reuse projects.

- Federal Historic Rehabilitation Tax Credit offers 10-20% direct tax reduction credit of eligible costs for income-producing buildings rehabilitated under standards set by the Secretary of the Interior. [14]

6-D: Temporary art exhibits - Events can bring awareness to historic structures and inspire "Friends Of" groups to organize capital campaigns for renovation.

What we stand to gain:

The viability and profitability of adaptive reuse has been demonstrated throughout the country. The unique context of the Delaware Waterfront offers the chance to reconnect to the past by way of the future. The larger landscape narrative of the Delaware relies upon the protection of significant historic structures.

7 INTERACTIVE PLANNING

Education – Public Awareness Campaigns – Competitions – Programming

Issue:

What is the next level of interactive planning? As plans for the future of the Delaware Waterfront progress, the planning process must continue to engage multi-disciplinary teams and public bodies, but there are always opportunities to advance the tools and methods of interaction. Changing demographics and social dynamics demand that the process not stagnate in outdated modes. In addition, large renewal campaigns have a history of demolishing neighborhoods with little regard to the merits of its existing fabric. In order to avoid the mistakes of the past, future planning must reach out in ways we have not yet witnessed.

Strategies:

7-A: Interactive Planning Process - As development on the waterfront continues, encourage planning participation at multiple levels via interactive gaming tools that communities can access via the internet.

- Example: San Franciso's Let's Green This City: www.letsgreenthiscity.com
- Clearinghouse for green initiatives, how-to's, classes, and calendar of public events
- Multilingual campaigns with specific strategies for different community needs

7-B: Programming

- Riverfront development corporations can team up with state and city agencies, local schools, and prominent businesses to bring awareness, activity, and programming to the waterfront.

7-C: Signage

- Signage at the waterfront should reveal the larger picture even as the waterfront is developed incrementally.
- example: Rosie the Riveter National Historical Park, Richmond, California. [15]

7-D: Catalyst projects

- Catalyst projects can jumpstart change but only if they are publicized, documented, and replicable.

7-E: Design Competitions

- Promote design competitions for exemplar buildings, parks, and technologies.
- Focus on the immense resource of Philadelphia's colleges and universities as think-tanks for problem-solving.
- example: The Green Initiative Fund at University of California, Berkeley [16]

7-F: Education

- Secure foundation grants for Eco-experience programming on the Delaware
- Implement training programs for local educators.
- Tie to regional, national and international ecological river programs.
- example: GREEN- Global Rivers Environmental Education Network www.earthforce.org/section/programs/green
- example: Carnegie Science Center, Ohio River, Pittsburgh

What we stand to gain:

Involvement of a community in the planning process is vital and revealing. New methods for local involvement may reveal long-held truths that have not been accessible by prior methods and thus guide the planning process to new successes in Philadelphia's unique neighborhoods. At the other end of the scale, we now have access to global knowledge and talents. Local, national, and international design competitions generate profound ideas and also bring publicity to Philadelphia's goals for the Delaware Waterfront.

www.letsgreenthiscity.com

www.urbancircus.com.au

8 CREATING & RESTORING HABITAT

Issue:

It has been estimated that 95% of the once contiguous freshwater tidal wetlands on the Pennsylvania side of the Delaware has been destroyed (Kreeger 2005).[17] The decline of this habitat has had deleterious effects on the numbers and health of wildlife populations and has severely reduced the land's ability to perform the critical functions of a healthy ecosystem.

Strategies:

8-A: Go Native

- Native vegetation supports the requirements of local biota community populations
- Use local genetic stock – Plants that have reproduced sexually (by seed) in the surrounding areas are adapted to the conditions unique to this environment, requiring less maintenance.
- A strong gene pool is the basis of bio-diversity and enables adaptation to change.

8-B: Protect from wake

- Wake from passing ships create swells which are detrimental to habitat establishment
- Wave attenuation structures prevent destruction of sensitive habitat by wake.
- Revetments or submerged reefs should be sigmoidal in shape and placed in numerous positions to dissipate force coming from many directions. These designs should be multi-functional and support more than one purpose.

8-C: Allow for normal tidal action

- Obstruction of normal tidal exchange fragments habitat.
- Daily change in water level creates aerobic – anaerobic conditions that are vital to survival of the species who live in intertidal wetlands as well as associated communities (upland marsh etc.)
- The flushing action that occurs with tidal waters brings in essential nutrients.
- An unobstructed, gradual slope of the littoral shelf allows for daily inundation and desiccation cycles as well as periodic flooding important for palustrine systems upland.

8-D: Increase edge conditions: ecotones and smooth transitions

- Ecotones, or transition areas between adjacent ecosystems, allow communities to exploit the resources from more than one set of habitats.
- This contributes to species diversity, more edge conditions, more opportunities for varied habitat.
- Gradual slope from submerged to upland areas allow for ecotones that have evolved relationships overtime.
- Bulkheads can be modified/retrofited to work with habitat models.

8-E: Micro + Macro habitats within a contiguous corridor

- Maintain corridor contiguity. Even a narrow width of trees offers some habitat benefit.
- Different species have different requirements; integrating edge conditions and gradual depth fluctuation creates micro-habitat conditions that allow for many different species to thrive in close proximity.
- Larger habitat "islands" support ecotones by providing a stable "home base."

8-F: Design for top predator species

- Upper level trophic or predator species like the osprey (*Pandion haliaetus)* and the striped bass (*Morone saxatilis)* have large habitat requirements that include smaller, more specific habitat requirements for their prey. Planning for these species will incorporate a range of animals and vegetation that support them.

8-G: Let sleeping pollutants lie

- Releasing pollutants that have been locked in situ within the soil column into the water has negative effects on surrounding life
- Use plantings and the bacterial relationships associated with their root structures to break down pollutant compounds overtime

What we stand to gain:

Urban habitat restoration is more viable along the Delaware River than anywhere in the city because of the tidal processes and links to the estuary. Urban biodiversity reconnects city people with nature and a fundamental part our being. Biodiverse ecosystems are more resilient, adaptive, and better able to provide ecosystem services.