infrastructure AND community

How can we live with what sustains us?

e

ENVIRONMENTAL DEFENSE

finding the ways that work

AND

Michael Singer Studio

infrastructure AND community

How can we live with what sustains us?

AUTHORS

Michael Singer
Ramon J. Cruz
Jason Bregman

e

environmental defense
finding the ways that work

AND

Michael Singer Studio

CREDITS

We would like to acknowledge the many individuals who contributed to this report including **Nancy Rutledge Connery** for her diligent review, editorial suggestions and the afterword, **Michael Fishman** at Halcrow Inc. for his collaboration and insight and our other reviewers:

Hillary Brown, Principal, New Civic Works
William D. Browning, Partner, Terrapin Bright Green
Charlie Cannon, Co-Founder, LOCAL Architecture Research Design
Calen B. Colby, P.E., Senior Engineer, OEST Associates, Inc.
Diane Elliott Gayer, Architect—Community Planner, Vermont Design Institute
Richard G. Little, AICP, Director, The Keston Institute for Public Finance and Infrastructure Policy, University of Southern California
Adi Shamir, Executive Director, Van Alen Institute
Peggy Shepard, Executive Director, WE ACT for Environmental Justice
Rae Zimmerman, Director, Institute for Civil Infrastructure Systems, Robert F. Wagner Graduate School of Public Service, New York University

Special thanks also to **Andrew Darrell**, Director of the Living Cities Program at Environmental Defense, **Dan Muggeo** at Daniels and Roberts Inc., **Laurie Hunter, Andrew Hughes**, **Ann Kelly,** and **Brian Quinn**.

Our mission
Environmental Defense is dedicated to protecting the environmental rights of all people, including the right to clean air, clean water, healthy food and flourishing ecosystems. Guided by science, we work to create practical solutions that win lasting political, economic and social support because they are nonpartisan, cost-effective and fair.

Printed on 100% post consumer recycled fiber, Forest Stewardship Council Certified, processed chlorine free.

The complete report is available online at www.environmentaldefense.org.

Project Credits

Phoenix's 27th Avenue Recycling Facility

Artists/Designers: Michael Singer and Linnea Glatt
Design Team: Sterling McMurrin, Richard Epstein, and Dino Sakellar
Engineers: Black and Veatch, Inc.
Project Managers: Gretchen Freeman, Phoenix Arts Commission and Ron Jensen, Director, Phoenix Department of Public Works
Photography: David Stansbury and Craig Smith
CELE Design Team: Michael Singer Studio, Linnea Glatt, Laurel McSherry, Frederick Steiner, Blackbird Architects, and the Arizona State University Schools of Architecture and Planning

Marine Transfer Station

Artist/Designer: Michael Singer
Project Team: Peter Nobile, Architect, SBRA, Calen Colby, Engineer, OEST Associates Inc., John Guminak, Designer, Trevor Lee, Designer, Michael Fishman, Urban Design
Environmental Defense: Andy Darrel and Ramon Cruz, Project Directors

TGE Cogeneration Power Facility

Artist/Designer: Michael Singer
Project Team: Marcus Springer, Architect, Cannon Design, Calen Colby, Engineer, OEST Associates Inc., William Reed, Integrative Design Collaborative, Jaimie Cloud, Founder and President, Cloud Institute for Sustainability Education, John Guminak and Trevor Lee, Drafting, and Nancy Rutledge Connery, Infrastructure Policy Advisor, Michael Shaw at Ocean Arks International

Photo Credits:

Page 8: Adam Lubinsky (top right)
Page 10: Columbia University School of Architecture Department of Planning and Preservation- Progressive Architecture (November 1985) (left), Library of Congress American Memory Collection (bottom right)
Page 11: Steven Holl Architects - photo by Paul Warchol (bottom left), Crivillers i Arquitectes assoc. - photos Iñigo Bujedo Aguirre (top right), http://www.arch-hiroshima.net (bottom right)
Page 20: Luz and Partner (bottom left)
Page 21: Courtesy of Tampa Electric Company- photo by Bob Waselewski (bottom left), Google Maps (top right), Microsoft Live Search Maps (bottom right)
Page 23: Courtesy of DOE/NREL (bottom left)
Page 24: PV Systems (EETS) (bottom left)
Page 25: Courtesy of DOE/NREL (top right), Courtesy of Greenfuel Technologies Corporation (bottom right)
Page 28: Demolition Depot (bottom left), Courtesy of Hudson River Park Trust (top right)
Page 29: Amy Stewart (top right)
Page 31: Google Maps, Natural Systems International (bottom right)
Page 32: © ZinCo GmbH (right side)
Page 37: © Dieter Leistner / artur (top right), Anthony Oliver (bottom right)

Images not listed were provided by the authors.

EXECUTIVE SUMMARY

The Challenge: Infrastructure in Community Context

Society depends on the quality of its infrastructure. Though the functional necessity of waste-disposal services, water treatment centers, transportation systems and energy networks is indisputable, these facilities are often planned and placed to be out-of-sight and out-of-mind. Essential infrastructure is cast in the public imagination as disruptive, hazardous and unsightly. Frequently, the public considers visible infrastructure to be symbolic of government disregard for communal well-being.

This paper advances a different vision. The case studies, historical and contemporary precedents presented here demonstrate that a responsibility of infrastructure, beyond utility, is providing an element of civic pride to a community. The next generation of energy sources, water systems and waste facilities must be conceived of with the assumption that infrastructure represents an asset in each and everyone's community. This paper makes evident that cooperation among communities, government officials and development agencies, public works can promote environmental justice, generate ecological renewal, inspire civic responsibility and enhance quality of life without sacrificing economic viability. This perspective is grounded on two fundamental principles:

- Integrative Design: Rather than using a predetermined approach, successful infrastructure aligns facilities with individual settings. Design that is responsive to the habitat and to specific light, wind and water conditions increases efficiency and reduces environmental impact. Design that attends to the needs and interests of local communities cultivates positive relationships between the agencies responsible for utilities and the populations that they serve.

- Public Engagement: By shifting the site of planning from the boardroom to the boardwalk, government agencies and developers enlist the support of public interest groups and local populations. The planning process can generate enthusiasm rather than opposition from stakeholders if community members are directly involved from the beginning. Collaboration and transparency help insulate development from legal and bureaucratic obstacles and enhance a project's sustainability.

The Outcome: Public Engagement, Civic Pride, Efficiency and Environmental Regeneration

Infrastructure and Community amends the maxim that form follows function. It expands upon the function of infrastructure to encompass a broader range of environmental and social interactions that address the common goals of the larger community. Rightly imagined and effectively executed infrastructure projects can become public places of cultural understanding and symbols of the evolving relationships among natural landscapes, industrial expansion and engaged society.

INTRODUCTION:

INFRASTRUCTURE AND COMMUNITY

Infrastructure is defined here as the facilities, services, distribution networks and installations needed for the functioning of a community or society such as water supply and treatment, solid waste facilities, energy networks, transportation and communications systems. Although these basic functions are necessary to sustain society, the facilities that provide these functions are, in most cases, opposed by those who are living or working in their vicinity. The potential for undesirable traffic, noise, bad odors and unappealing landscapes have become primary reasons for community rejection and antagonistic relations between municipalities providing services and those served. Given current formulaic infrastructure design and what citizens have come to expect, it is understandable why communities say “not in my backyard” (NIMBY syndrome), not wanting these essential facilities located anywhere near them.

The purpose of this paper is to put forward concepts and ideas that can integrate infrastructure with its surrounding community. The paper is also meant to support the officials, engineers and designers who are responsible for solving infrastructure needs. In the same way a museum or monument announces something significant, relevant and specific about aspects of civic life, infrastructure facilities can offer a similar vision and impact, and encourage awareness of their vital functions. These facilities have the potential to provide even more than their obvious service; they can positively affect their social, economic, and environmental surroundings.

The focus of *Infrastructure and Community* is on land- and water-based infrastructure in large urban contexts, where space constraints are often most visible. Many of these strategies are also applicable to smaller municipalities, and are interchangeable with any service infrastructure that is difficult to site. The goal is to provide elected officials, city planners, policy makers, engineering consultants and community leaders with a document that encourages creative thinking, sparks ideas that are outside of typical considerations, and results in new approaches in design and location of infrastructure facilities.

This paper was first conceived in the midst of a difficult debate in New York City about the location of a marine waste transfer station in Manhattan. Inspired by the successful construction of Phoenix’s 27th Avenue Solid Waste Transfer and Recycling Facility, Environmental Defense approached Michael Singer Studio to jointly develop ideas and concepts that would advance the debate and improve the design already proposed by the New York City government. The issues in Manhattan are part of a recurrent dynamic and the solutions to these problems can be applied elsewhere. Using examples from Michael Singer Studio, this paper presents these common ideas and concepts.

Courtyard at the Solid Waste Transfer and Recycling Facility, Phoenix, Arizona

CURRENT SITUATION:

WHY SHOULD THIS BE IN ANYBODY'S BACK YARD?

Anyone who is involved in locating basic infrastructure facilities knows that it is an uphill venture with many roadblocks along the way. City agencies or private developers often prefer to keep plans behind closed doors, out of the public radar, because of the fear that a project will be blocked. Only a generation ago, widespread eminent domain and massive relocation typical of the Robert Moses era were business-as-usual methods in most cities. We recognize that this situation has improved in most places in the United States, but there is still much distrust toward government agencies or developers among the general public. Even though these projects are subjected to an environmental review process under the National Environmental Policy Act or other regulations, these approaches often do not examine opportunities for more interaction with local people. Public hearings usually include only a small fraction of the community and, although organized to receive "input", such hearings typically do not engage in a true dialogue that responds to community comments or concerns. This results in a sense of powerlessness that makes citizens and community groups reluctant to engage in the public process. Therefore citizens may get involved in opposition and lawsuits rather than constructive engagement with government agencies over infrastructure projects.

Given the adverse impacts often associated with these facilities, it is understandable why communities often spend so much time and resources opposing infrastructure projects, especially when they would prefer to have open space and recreational facilities. Some facilities attract long lines of trucks that queue in neighborhood streets, burning diesel and contributing to high asthma rates. Others expel bad odors, toxic substances or noise that can have negative effects on the learning abilities of children. Although some of these problems might be inevitable, there are ways they can be mitigated, if not substantially eliminated. Addressing the concerns of a community in the early stage is an essential part of the planning process.

New models are needed. Government officials and developers can improve this situation. One necessary, fundamental change is transparency within the process. The earlier people know about a planned development and can have input, the more likely they will engage in a constructive dialogue. Communities need to inform the process. Another important change is challenging the conventional design of industrial facilities to integrate systems and incorporate sustainable design, thereby improving performance and aesthetic value.

There are various misconceptions surrounding sustainable design, which preclude innovation. Many developers and government agencies choose unimaginative structures, believing that designs that consider aesthetics and incorporate sustainability will raise project costs. The costs of lawsuits and lost time due to opposition needs to be accounted for when selecting the 'default' prosaic big box—as this is likely to help fuel strong opposition.

COMMUNITY BENEFITS:

HOW CAN COMMUNITIES GAIN RATHER THAN LOSE?

Community Benefits Agreement: A role model for effective development and process

Siting infrastructure facilities has become one of the most contentious aspects of today's urban planning. The best antidote is to engage the community in a meaningful way right from the start and to focus on transparency at every step thereafter. For example, even before site selection begins, the public should be involved in determining a clear set of evaluation criteria to guide the selection process.

It is important to take into consideration the impacts of other infrastructure facilities in the area. Cumulative impacts are often overlooked during the siting process and, as a result, the same communities end up hosting more than their fair share of facilities. This issue has been the mission of the Environmental Justice movement that took form in the 1990's. While the movement has led many states to develop "environmental justice" executive orders, a feeling of powerlessness and distrust in many communities still lingers.

To avoid long, frustrating hours opposing proposed developments in public meetings or courts, community groups and developers or government officials can engage in positive models of negotiation, that offer opportunities for partnerships and collaboration. When a developer or government agency actively partners with the community, the process can reveal and address the major concerns of the local community, yield environmental improvements and achieve faster and smoother project approvals. In several parts of the United States, successful developer-community partnerships have been codified in community benefits agreements (CBAs).

A CBA is a mutually enforceable, legally binding contract between developers and community leaders that improves a project's performance and wins local support. It provides a developer with the opportunity to build trust with residents. Under a CBA, a developer provides benefits to the local community and, in return, community groups agree to support the development as it travels through the cumbersome road of political endorsements, government permits and subsidies. The community also pledges not to impede the development with lawsuits as long as the developer follows the agreement.

Developers can be responsible neighbors and promote developments that protect health and improve the environment. This can be done, for example, through the use of environmentally friendly construction materials and reductions in pollution from traffic and construction vehicles.

As part of the $11 billion expansion of the Los Angeles International Airport (LAX), a $500 million Community Benefits Agreement was reached in 2004 with a broad coalition of local groups to mitigate environmental and other impacts. This largest CBA to date was negotiated for over ten months by 22 groups, including environmental, community, labor and religious organizations. The final CBA has three hallmarks. First, it provides for environmental mitigation measures such as retrofitting diesel construction and operations equipment, electrifying airplane gates (in order to avoid jet engine idling), using green building principles and clean energy sources, and alleviating environmental impacts by reducing the amount of noise, air pollution and traffic generated by the airport. Second, it includes studies of the environmental and health impacts of the airport. Finally, it requires the developer to provide local employment and to soundproof nearby schools and houses affected by increased air traffic.

Signing of the LAX Community Benefits Agreement

CBAs usually address some or all of the following:

- Environmental protection and improvement
- Economic development
- Job creation and security
- Educational programs and training
- Open space
- Community facilities and programs
- Affordable housing
- Historic preservation

HISTORICAL PRECEDENTS

America's historic infrastructure facilities once were objects of immense civic pride and sometimes monumental beauty. While utility and cost were just as important to early builders and civic leaders as they are today, these facilities also served as potent symbols of common purpose and progress in a young and rapidly growing nation. Clean water, sanitation and power were not yet taken for granted; in fact, the public eagerly celebrated their arrival. Magnificent structures offered testament to the crucial value of these services to peoples' lives and livelihoods and the sacrifices required to create them.

New York City first mixed asphalt at this site overlooking the East River in 1914. In 1944 the Municipal Asphalt Plant designed by Kahn and Jacobs was opened, becoming a modernist infrastructure icon. The Museum of Modern Art designated the building a masterpiece of functional design. The building's 90-foot arches are covered with reinforced concrete. Neighborhood activists saved the building and site in the 1970's, transforming it to Asphalt Green. The main building has been converted into the Murphy Center, housing art and photography studios, a gym with an elevated track, and the Mazur Theater.

The Baltimore Power Plant was built for United Railways' extensive city trolley car system between 1900 and 1909 by architects Francis Baldwin and Josias Pennington. The power plant complex is in the heart of the City's downtown Inner Harbor. In the early 1920s the plant was put to use making steam, which downtown buildings bought for heat for 52 years. As an iconic downtown building the power plant complex has been planned and modified for use as a hotel, an indoor amusement park, and a nightclub. The complex is currently occupied by various tenants and hosts "Power Plant Live" a series of outdoor entertainment events during the summer.

The Boston Water Works, Chestnut Hill High-Service Pumping Station was designed by City Architect Arthur Vinal and built in 1887. Its Romanesque style became the area's primary 'look' adopted by nearby residential homes. The property was designated a Boston Landmark in 1989; it is also listed on the National Register and the State Register of Historic Places. Today the site is being redeveloped as 108 luxury condominiums.

CONTEMPORARY PRECEDENTS

A new generation of innovative projects throughout the world may begin to compete with past icons in terms of public good and progress. Infrastructure metrics are changing; energy efficiency, environmental impact, public safety, integrated design and community harmony have become nearly as important as access to basic services. These few examples demonstrate how forward thinking public agencies and private developers have successfully engaged communities to meet rising service demands in expanding urban centers and still create beautiful outcomes.

The Park of Environmental Technologies in Majorca, Spain by Crivillers i Arquitectes Assoc. is an example of a facility designed to invite and inform the public about waste and recycling. The Central Building visitors complex was designed with raw and recycled materials and planned as a re-usable modular structure. From the Central Building visitors can take a tour of the entire facility on a monorail system to learn about the processing of recyclable materials, composting of organic matter, and the conversion of waste into energy. Through community interaction the Majorcan government hopes to transform public attitudes towards consumer products from "use and discard" to "discard and use". The Central Building was one of the top 12 winners of Spain's Green Building Challenge in 2005.

The Whitney Water Purification Facility and Park in New Haven, Connecticut by Steven Holl Architects, consists of water treatment facilities located beneath a public park and a 360-foot-long stainless steel building that encloses public and operational programs. The design is essentially a 30,000 square foot green roof park on top of the facility – creating a community amenity by merging open space with infrastructure. Sustainable design strategies include a ground water heat pump system to provide heating and cooling in the building, gravity flow water systems reducing the need for pumps, use of a previously developed site, use of local and recycled materials, and a landscape design that includes indigenous plantings and creates habitat value.

The Hiroshima Naka Incineration Plant was completed in 2004 to handle the City's increasing municipal waste. The City commissioned one of the country's best known museum architects—Yoshio Taniguchi to design the facility with an interior space to help inform the public about waste reduction and processing. The 400ft interpretive walkway connects one of the City's main boulevards to the waterfront, which would have otherwise been cut off by the building's massive structure. When processing waste at full capacity the facility also produces 15MW of electricity for local residents.

INTEGRATING DESIGN

CAN WE CREATE INFRASTRUCTURE FOR COMMUNITIES?

Regenerative Networks: Finding the Interactions

Public infrastructure can serve as a catalyst for interactive systems that help build and revitalize communities. By expanding conceptions of infrastructure, public facilities can develop beneficial rather than negative relationships with their surrounding economic, social and environmental networks and neighborhoods.

The “Regenerative Network” is a new model for infrastructure development. This model increases efficiency and adds functions to the facility that benefit the local community. It is initiated with an examination of the facility’s resources, such as the horizontal and vertical surfaces, and its functions. Depending on the resources and functions that are available, one can explore all the potential benefits infrastructure can provide. Shown to the right is a diagram created for a proposed marine waste transfer station. The station receives municipal waste (household and commercial trash) in trucks and transfers it to barges which are moved to processing centers. This model integrates social, educational and environmental possibilities that are essential to the design and planning process.

In this model, infrastructure becomes an asset and a resource to the community. In fact, the Regenerative Network increases economic benefits by incorporating external benefits not often considered in traditional infrastructure business models. Some of these benefits can include habitat creation, educational centers and wastewater treatment. The following sections of this paper provide numerous further examples.

RESOURCES

- Building surfaces
- Energy—solar (Roof)
- Water—rain (Roof)
- Open space and green space
- Reusable / recyclable materials

EFFICIENCY BENEFITS
(Centralized Operations)

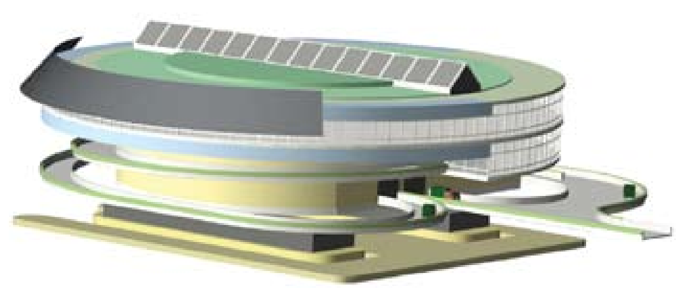
- Queuing of trucks on site
- Barge transfer system
- Garage on site
- Vehicle maintenance on site
- DSNY administration offices

ENVIRONMENTAL BENEFITS

- Emissions reduction
- Maximizing recycling
- Air filtering
- Odor control
- Rooftop photovoltaic panels
- Biological wastewater treatment
- Water storage and reuse
- Additional open green space
- Habitat creation

SOCIAL BENEFITS

- Sustainable facility
- Solid waste transfer
- Recycling
- Education center
- Community gardens
- Community programs
- Material recovery center
- Open space
- Waterfront access
- Aesthetic appeal



The Regenerative Network Diagram for the Marine Transfer Station Facility shown as an example. Each facility will have its own site and diagram. More information about the Marine Transfer Station and how the Regenerative Network evolved into specific design concepts can be seen in the following sections.

A GUIDE TO INFRASTRUCTURE PLANNING AND DESIGN:

CASE STUDIES AND CRITICAL TOPICS

This paper uses examples drawn from Michael Singer Studio's work, which were selected to illustrate how design, a commitment to environmental performance and community engagement can yield lower impact, cost efficiency and community support in proposed infrastructure projects. Although there are other designers and engineers engaged in the challenges of uniting infrastructure with communities, the authors selected three projects by Michael Singer Studio for their breadth of innovative design. These selected case studies explore opportunities within infrastructure projects to reduce the impact in their neighborhood.

The next four pages describe the history and context of each of these projects. Even though only one of the selected projects has been built, the ideas and concepts presented here are intended to spark dialogue and encourage innovation for future infrastructure projects, especially in dense (and growing) urban environments. Every site and project is unique. What these examples show is that designing in a cost-effective way that is responsive to local health, the environmental needs of a region and the global demands of climate change can transform even the most undesirable facility into a better neighbor. This document also makes reference to additional precedent-setting projects by Michael Singer Studio and other design, architecture and engineering offices.

Following the case studies, five chapters cover critical topics: site context, energy, public access, water management and architectural design. These topics examine each of the three projects in more detail, explaining how each facility addresses the critical topics with the overall goal of creating infrastructure that is environmentally, economically and socially beneficial to the surrounding community.

Site Context: Ecology, Community and Habitat

Energy: Consumption, Infrastructure and Life Cycle

Public Access: Education, Business and Recreation

Water Management: Filtration, Reuse and Responsibility

Architectural Design: Aesthetics and Function

A Recycling Facility as a Place for Public Amenities, Involvement, and Education

Case Study One:
Solid Waste Transfer and Recycling Facility, Phoenix, Arizona, 1993

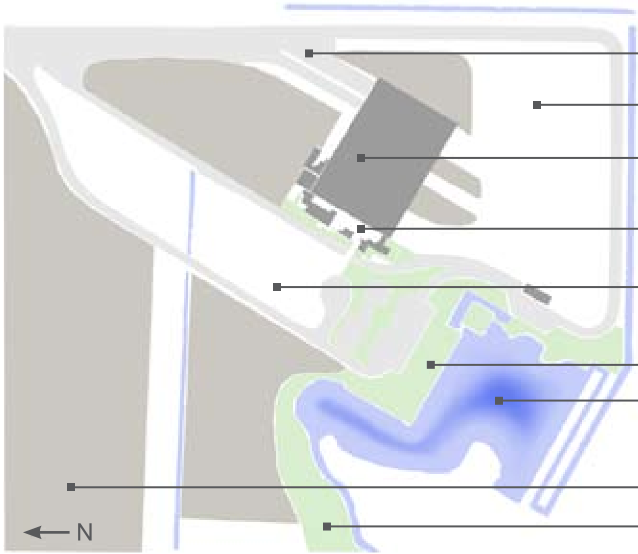
Phoenix's 27th Avenue Recycling Facility is a well-known national model that has won several awards, was featured in many publications and is credited with promoting aesthetic design excellence for infrastructure in the U.S. In 1993, The New York Times chose the design as one of the eight most important architectural events of the year. The facility also helped the Phoenix Department of Public Works site other waste transfer and recycling facilities in communities throughout the city, without contentious hearings.

The project transformed "out-of-sight, out-of-mind" infrastructure into an a dynamic facility that stands out proudly within the city's landscape. At the forefront of the design is the use of all elements of the facility and site—buildings, roads, landscape, water and wildlife habitat—as a way to engage the public in the recycling mission and take pride in a public works civic structure.

Some concepts presented in this document expand upon opportunities that were not a part of the original implementation plan.

Spaces and amenities within the facility were designed for employees as well as visitors. Left, a shaded courtyard garden; above, the pedestrian bridge provides the main public entrance.

Above, view of the primary public facade of the recycling and waste transfer facility which uses an elevated terraced landscape to separate visiting pedestrians from the truck traffic below while creating a welcoming entrance.



General Site Diagram

Lessons from Phoenix

Solid Waste Transfer and Recycling Facility, Phoenix, Arizona, 1993

Cost Analysis and Benefits:

The 27th Avenue Recycling and Transfer Facility was approved and bonded at a cost of $18.5 million, based on an initial concept study estimate. This estimate included program spaces for visitors and operating machinery for the facility.

At the request of the Department of Public Works, the Singer/Glatt Design Team redesigned the concept site plan, to improve truck and small vehicle circulation patterns, move the self-haul area closer to the main building, enlarge landscaped areas and rotating the main building's orientation on the site to reduce noxious odors to employees and visitors. The Singer/Glatt Design Team also reworked the structural strategy for the building and added a multipurpose community room, laboratory, exhibition space and office spaces for private and nonprofit organizations.

The total cost of the completed and fully redesigned project was $14 million, $4.5 million less than the initial design estimate. Within two years, the Department of Public Works replaced the original operating machinery with an advanced and fully automated system to meet the unexpectedly large volume of recyclable waste coming to the facility.

The large steel trusses of the building can be seen from miles away, and have become a symbol of the facility and its recycling operations. Heliostats (solar tracking mirrors that direct light into the interior through skylights) can be seen on the rooftop in this image.

Design Strategies To Reduce Costs:

The initial design estimate included costs for bringing large quantities of fill to raise the ground elevations at the site and have the facility floor above the flood plain. The Singer/Glatt Design Team reduced costs by using on-site excavated fill to create a large water retention area. This strategy saved trucking and fill costs and provided an attractive landscape amenity.

The original facility design included many interior columns. The Singer/Glatt Design Team eliminated all but one central interior column to create more flexible interior space and replaced them with support columns on the building's exterior, along with supporting plate girders. This opened the interior space of the building for future needs, as it was anticipated that the spatial requirements of new recycling machinery would change over time. These structural design changes resulted in sizeable cost savings by enabling the Department of Public Works to upgrade the operating machinery without the need for structural alterations.

The Singer/Glatt Design Team decision to not construct enclosures for the steel structure was both an aesthetic strategy and cost-saving approach. The large exposed steel trusses can be seen miles away and have become the symbol of the facility. The process of erecting these enormous beams was televised and became a news event in the region, adding to the public's anticipation of a recycling and transfer facility that was beyond most imaginations.

Cost savings were realized by specifying undecorated, off-the-shelf raw materials and finishes that were durable, economical and readily available. The design team chose these materials and finishes for their aesthetic quality as well. For example, precast concrete columns and surfaces were left naturally rough (without the added cost of stucco sacking) and concrete block was selected for its use of local aggregate.

Solar tracking skylights provide an abundance of natural light to the interior of the facility throughout the day, and help reduce utility costs. The landfill adjacent to the facility captures and uses methane to power a small cogeneration facility at the site. The generated power is used by the facility and distributed onto the network. The Singer/Glatt Design Team identified an opportunity for a solar hot water installation. The facility uses large amounts of hot water for washing trucks and the interior of the recycling building. The solar hot water panels were designed as shade structures along the south façade visitor catwalk. Unfortunately, at the time of the Design Team's proposal, Phoenix had an ordinance against the use of solar hot water systems and photovoltaic power generation for public buildings. If this facility were to be built today, additional strategies to make the facility more energy efficient and independent would be incorporated, providing further cost savings in the facility's operations.

A Solid Waste Transfer Facility Overcoming NIMBY and Integral to its Surroundings in Both Function and Form

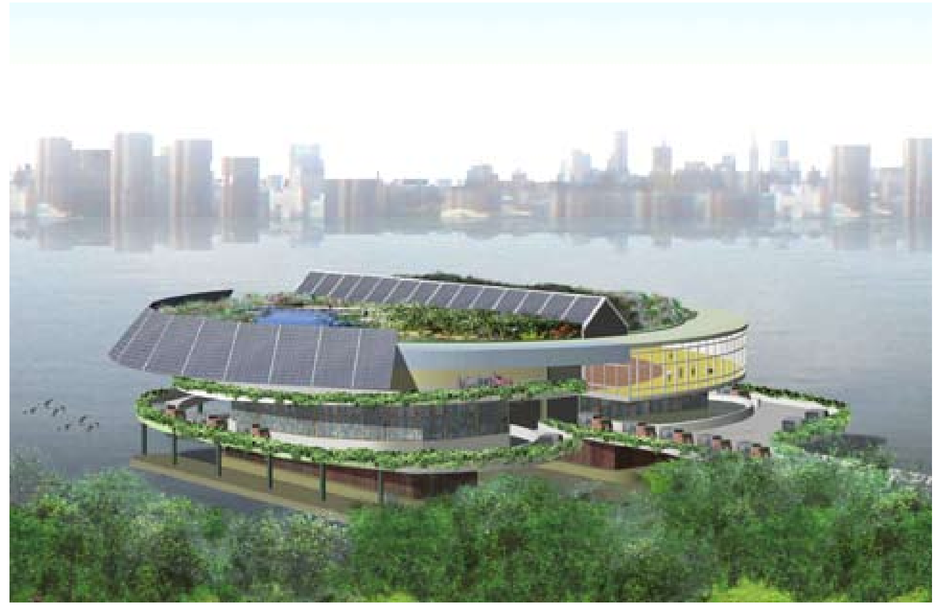
Case Study Two: Marine Transfer Station, Manhattan, New York, 2004

New York City's Mayor Bloomberg presented a desperately needed Solid Waste Management Plan addressing how trash is moved in the city. The key to the plan's success is building a network of rail and marine transfer stations equitably sited throughout the City. Even though citizens understand the quality of life, economic and environmental consequences if these facilities are not built, there is still strong opposition to the placement of waste transfer facilities in waterfront neighborhoods. Citizen groups have vowed to fight this to the "bitter end."

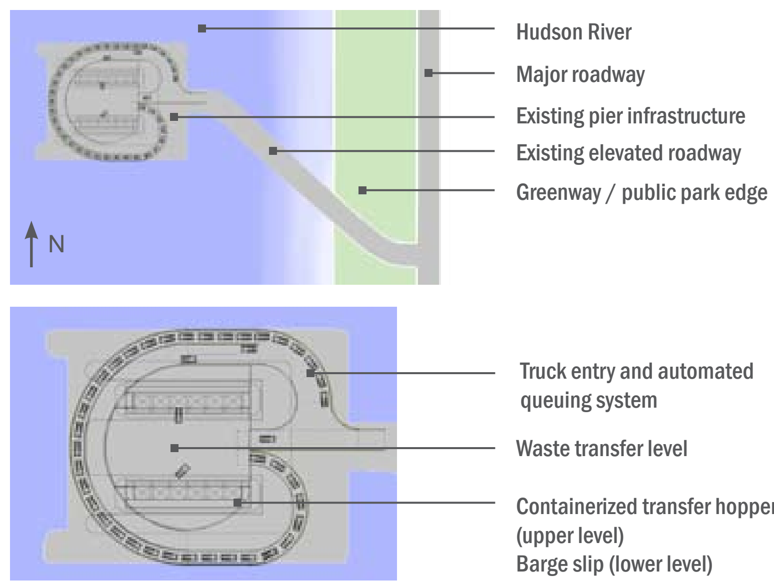
The first task of this Marine Transfer Station (MTS) proposal involved an investigation of community concerns, thereby turning the public into partners in the design process. The goal of the proposal is a feasible, well-functioning facility offering social, aesthetic and environmental benefits rather than the usual negative by-products, like traffic congestion, air pollution and visual eyesores. The Phoenix, Arizona, 27th Avenue Solid Waste Management Recycling Center serves as a precedent, affirming such strategies are possible.

Every aspect of the proposed MTS—walls, roofs, and interior spaces—provide opportunities to address community concerns. Among the most important community complaints against existing marine transfer facilities is the long queue of smelly, noisy trucks in local streets. The proposal addresses this problem with an automated ramp system that accommodates all the trucks of the district. Upon entering the site, drivers would be required to turn off their engines to reduce noxious emissions.

Other citizen complaints note the visual impacts of standard metal sheds blocking waterfront views and access. This MTS study proposes architectural forms that follow the sanitation department's functional needs while providing the visual interest of a naturalized growing habitat and water-cleansing roof, solar panels, queuing ramps with vegetated air purification buffers and large glazed walls for public viewing of the waterfront. Some of the ample interior spaces and roof area can be used for community activities, educational programs and offices for local organizations. In addition, the land adjoining the MTS is transformed into a spacious waterfront park and gardens for public enjoyment.



Above, a rendered view of the proposed Marine Transfer Station with a naturalized green roof, building -integrated solar panels, automated truck queuing ramps with vegetation buffers, and spaces for administration and public access.



General Site and Facility Diagrams

A Power Generation Facility as a Community and Environmental Resource

Case Study Three: TGE Cogeneration Facility, Greenpoint, New York, 2002

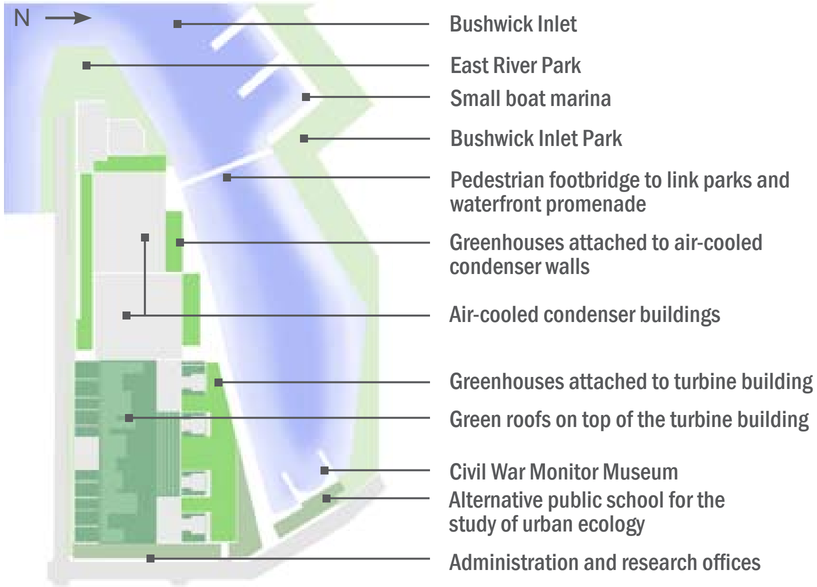
The Trans Gas Energy Corporation (TGE) Cogeneration Power Facility study demonstrates that there can be a close positive relationship between a Power Plant and its surrounding community- a communion between functional needs, public needs, environment and exciting design.

An investigation of the systems of this facility (waste heat, stormwater runoff, exterior walls and the emission stack) resulted in an understanding of the opportunities to renew a dismal brownfield site and regenerate its social and environmental surroundings. Integrating these systems revealed feasible design and program approaches that demonstrate how the buildings and site of the facility can become an armature for interconnected systems including habitat creation, education, recreation, work space, water preservation and urban agriculture.

Above, a sectional diagram of functions built upon the building's systems and structure. Vertical green houses, terraced gardens, and green roofs are layered throughout the facility.

TGE included this design as an alternative for their Article 10 application to the New York State Public Service Board in 2003. The inclusion of this project here is not an endorsement of TGE, and its proposals or statements about the site (past, current, or future) by Environmental Defense or Michael Singer Inc. Rather, this study is a demonstration of how power generation facilities could interact within an urban context.

Above, a rendered view of the proposed TGE Cogeneration Power Facility with green houses providing an urban agricultural system, offices, and educational and cultural facilities. The facility's roof and walls provide the support for structures that wrap and create variation along the otherwise monolithic building.



General Site Diagram

SITE CONTEXT:

- ECOLOGY
- COMMUNITY
- HABITAT

How can infrastructure be sited to serve the community in an equitable way?

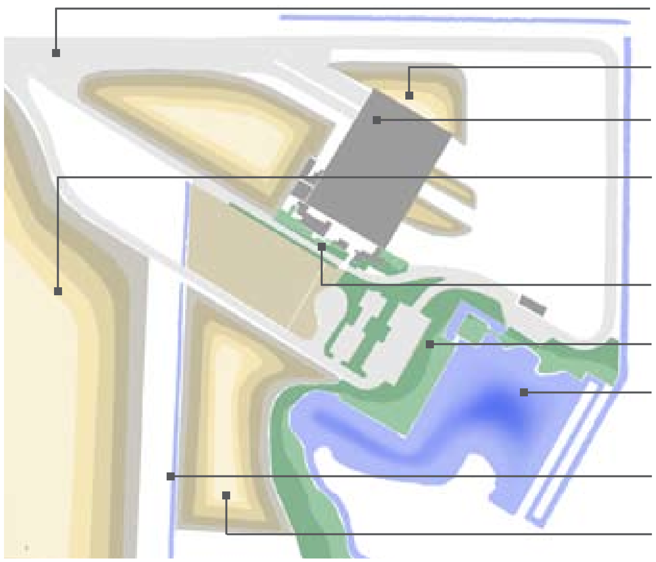
- Clearly identify the evaluation criteria for siting a new facility and make the site selection process public and transparent.
- Answer community health concerns by ensuring the safest available operating systems.
- Clearly identify mitigation strategies to reduce environmental and public health impacts in business or residential communities.
- Communicate clearly and honestly about why it is important to locate the facility at this particular site.
- Recognize “Environmental Justice” as a means for communities to equally share infrastructure facilities.

How can infrastructure interconnect ecological systems and add health to the environment?

- Do a site analysis identifying and locating natural systems and habitats, water quality, soil types, wind conditions, view corridors, and sunlight.
- Identify facility functions whose waste, product, or structure can be used to enhance the natural systems and habitats at the site, encourage new habitat, and generate healthy natural systems beyond the site.
- Require the facility design to be site specific, non formulaic, and responsive to the conditions of sunlight, wind, topography, views and natural systems on the property.
- Consolidate facility functions to provide an open space buffer to adjacent communities which also functions as habitat creation.

Solid Waste Transfer and Recycling Facility, Phoenix, Arizona

Site Context Case Study One



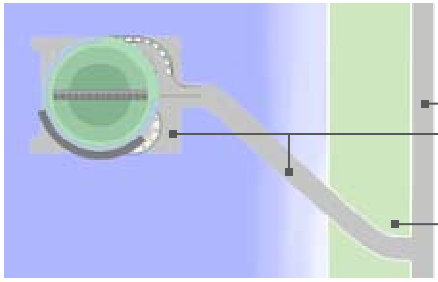
The Phoenix Solid Waste Transfer and Recycling Facility was sited in a rapidly growing transitional area to reduce long-term truck hauling and corresponding fuel consumption, air pollution and cost. Because the facility was sited near an existing closed landfill, an approach was taken to use topography to blend with the existing site and reduce the visual scale of the facility. The designers were also able to work with the community to establish desired amenities and environmental enhancement on-site and in adjacent areas to create an integrated facility that is largely viewed as a community asset. Above, the terraced and vegetated "public face" of the facility from the pedestrian bridge entry.

The Rio Salado (Salt River) adjacent to the site. The original design proposed to link the retention pond on-site with the environmental systems of the river in order to assist local restoration efforts.

The facility was intentionally sited on disturbed and contaminated industrial land. The siting allows for local access for trucks, reducing the necessary distance travelled for each load of waste or recyclables.

A model showing the use of desert berms to mitigate the scale of the facility. Soil fill used to raise the facility above flood levels was taken from the soil cut from the ground to create the retention pond. A balance of soil cut and fill is an important strategy to reduce pollution, costs, and energy.

Site Context Case Study Two

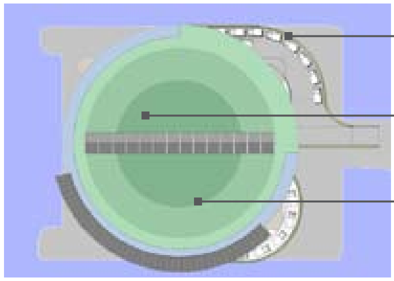


Sited near region serviced, with fewer localized impacts due to waterside location

Use of existing major roadway

Reuse of existing infrastructure greatly reduces additional environmental impacts to a recovering fragile waterfront ecosystem

Use of waterfront open space near facility as a public park with an emphasis on regenerating land to support wildlife habitat



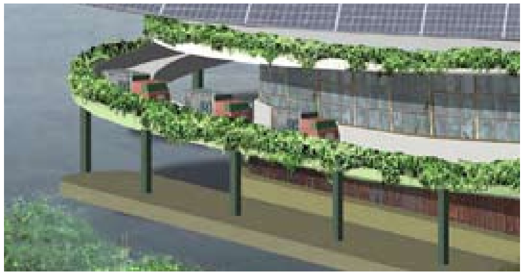
Extended ramp and automated queuing system created to reduce environmental impacts of idling trucks on the local community

The design of the facility allows trucks to be cleaned and stored within the building itself—opening up valuable waterfront land as a public park

Green naturalized roof creates an avian habitat island within a migratory flyway. Green roof maintained in part through on-site composting facility and collected stormwater

One of the most common community complaints about waste transfer facilities is truck queuing (above). To address this issue, the proposed Marine Transfer Station uses a winding automated truck queuing ramp surrounded by densely planted green walls (below). This system was created to minimize truck idling (engines are turned off) within adjacent neighborhoods by incorporating the queue within the structure itself. The planted walls add a layer of visual mitigation and odor control through an air-to-soil filtration system. The combination of planted walls and the large green roof system provide water filtration and storage of water for truck cleaning. The planted roof also provides a flyway habitat stop for migrating birds.

One strategy for the MTS is adding plant material and permeable surfaces wherever possible, primarily for visual mitigation and water filtration. In the urban context this "greening" also serves to reduce the urban heat island effect through evaporative cooling, shade and the reduction of dark paved surfaces and roofs. Above, example of planted terraces that would wrap the ramps, offices and visitor's center at the MTS.

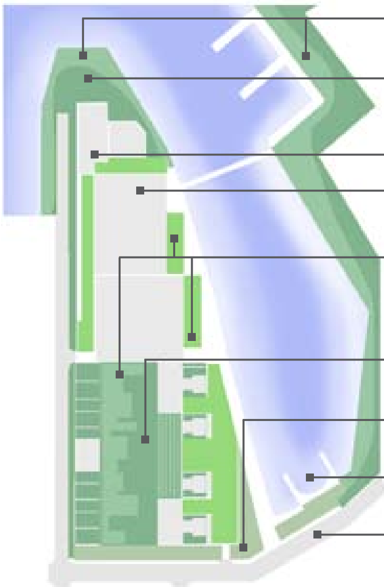


Green walls and terraces mitigate the visual impact and scale of the facility while functioning to filter water, air, and noise pollution. See the Architectural Design section for more related information on this subject.

Left, example of an existing MTS with fenced storage areas on the land side of the facility. The improved MTS design incorporates truck storage on upper levels of the facility, opening up valuable waterfront land for parks and environmental enhancement.

TGE Cogeneration Facility, Greenpoint, New York

Site Context Case Study Three



Adjacent open space proposed as parkland and a community marina

Power facility sited on an existing petroleum refining and storage brownfield with planned remediation

Existing industrial building retained as artists' studios

Facility sited for proximity to existing steam, gas, water and electrical interconnections (see right)

Green roofs, greenhouses and native plant nurseries function off of the building's waste heat, waste water and energy to create new local green industries with reduced operating costs

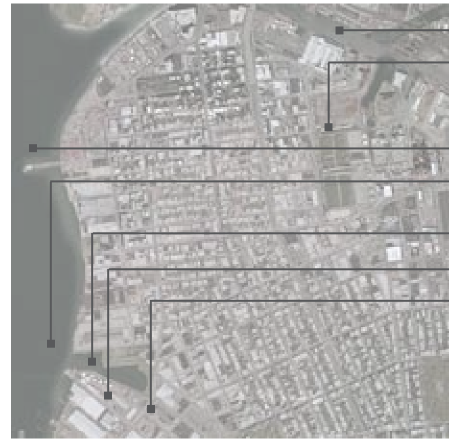
Green roofs, planted terraces and open space designed to support wildlife habitat

Community school, arts and meeting facilities integrated into the primary building facade

Historic site of the Civil War Monitor Shipyard restored as a part of site renewal

Replacement of existing petroleum storage facility will remove the environmental impacts of up to 300 fuel trucks per day which currently access the site through local roads and neighborhoods

Tampa Electric offers an excellent example of a power facility integrating with it's site and ecological context. For the past twenty years the general public and school groups have visited the Manatee Viewing Center beside the discharge canal of Tampa Electric's Big Bend Power Station. This canal is where manatees gather when the temperature of Tampa Bay drops below 68 degrees Fahrenheit. The Center offers tours and school programs and hosts a 7kW solar array. The viewing platform is surrounded by native mangroves. Regionally, other power facilities provide similar habitat areas which help the manatees avoid cold stress and cold-related diseases.



Newtown Creek

Newtown Creek Water Pollution Control Plant (water interconnect)

East River

Steam interconnect (underwater)

Bushwick Inlet

TGE site

Interconnections to existing energy transmission system, gas line, and MTA dewatering pumps (secondary water source)

The single most important factor in the siting of the TGE facility is the site's proximity to existing networks of reclaimed water, gas, steam and electrical infrastructure (see above). These interconnections allow the TGE facility to devote more investment towards community benefits through the integrated methods of the Regenerative Network. The TGE building design shows how waste heat and water from the facility can be captured on-site and used in greenhouse-structured facades to create vertical agriculture, nurseries and research labs while reducing the visual impacts of the monolithic building. New parks, access to the water, community buildings and remediation of the existing contaminated site are also proposed to help offset negative impacts to property values in the area.

Above, the existing Bayside Oil Terminal. The current and historical uses of this site have left the soil heavily contaminated. The siting of the TGE facility will bring the capital investment needed to remediate the site and reduce further potential contamination.

ENERGY:

- CONSUMPTION
- INFRASTRUCTURE
- LIFE CYCLES

How can a facility reduce operational energy consumption and the impact of its function?

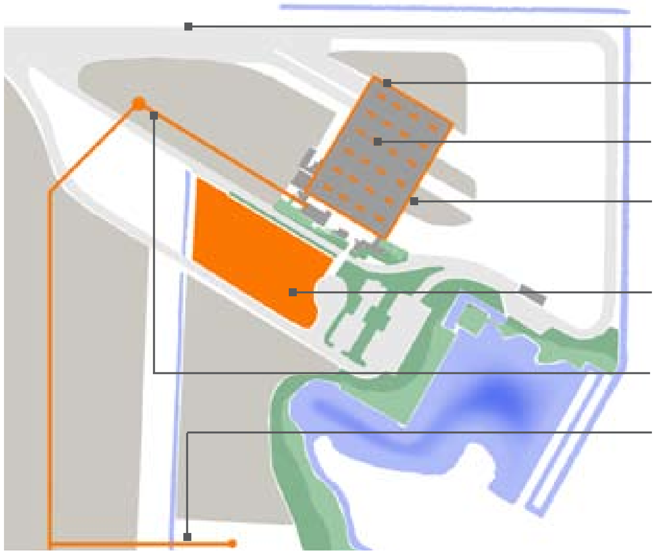
- Locate infrastructure near the population it serves, thus increasing efficiency and reducing energy consumption and long-term operational budgets.
- Consider use of existing local infrastructure connections such as roads and utilities to avoid redundant networks.
- Ensure an optimal sustainable facility by balancing the short-term and long-term energy expenditures. Operational energy (see glossary for definitions) greatly outweighs the other forms of energy over time. Realizing and designing small efficiencies in advance will have significant long-term energy conservation benefits.

How can infrastructure work with renewable energy?

- Establish renewable energy goals at the outset of the project.
- Use the overall function and structure of the building to provide renewable energy, especially where visible for public programs and renewable energy demonstrations.

Solid Waste Transfer and Recycling Facility, Phoenix, Arizona

Energy Case Study One



The giant truss structures create interior flexibility and allow for large sections of natural light to enter the building. Raw concrete was left untreated to blend more with the environment while reducing unnecessary cost and energy expenditures.

Composting operations on-site reuse valuable organic materials with little processing and energy.

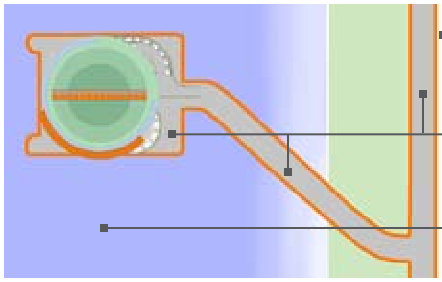
Long-term operational energy use and potential facility reuse were key factors in the design of the Phoenix Solid Waste Transfer and Recycling Facility. Facility lighting is greatly reduced through skylights, heliostats and increased glazing wherever possible. Glass block is intermingled with standard CMU block to create a varied facade and allow dappled light into the administrative wing (above). Use of lexan panels, windows and glass block also punctuate the envelope of the main floor of the transfer station to maximize natural lighting and allow views into the facility during public tours (below). Reducing artificial light decreases energy consumption and creates improved working conditions for facility staff.

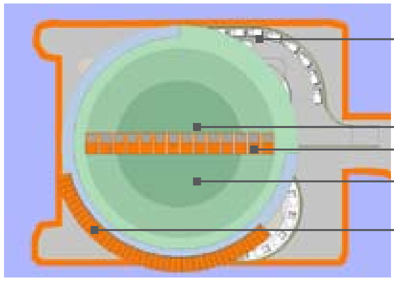
The facility was designed as a flexible open space (shown above) so that the building could accommodate future configurations of mechanical equipment as well as future uses of the entire facility. For instance, if waste management operations change, the facility could be re-used as a large indoor community center.

Left, heliostats (solar tracking mirrors) direct sunlight into the skylights at the Phoenix facility to increase natural light and reduce daytime peak energy consumption.

Marine Transfer Station, Manhattan, New York

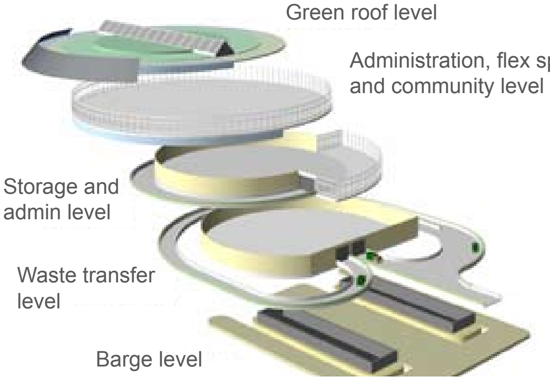
Energy Case Study Two





Left, south-facing photovoltaic panels and a central skylight reduce the facility's reliance on grid-supplied energy, potentially allowing the primary operations to function during a blackout.

Left, an example of photovoltaic panels integrated into a building's facade. This system is a 85kW wall on the Welsh Development Agency Technology Center in St. Asaph, North Wales. The 11,000 square ft. solar wall produces energy equivalent to the needs of approximately 25 typical single family homes.

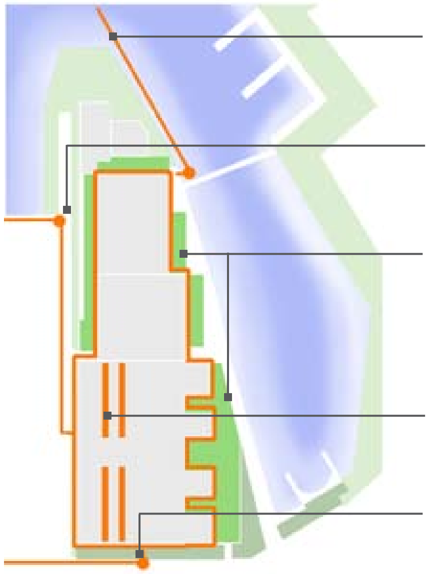


The Marine Transfer Station reduces operational energy consumption and environmental impacts through the design of technical systems. The primary innovation is the use of an automated truck queuing system ramp which allows trucks to be conveyed through the facility at an even rate rather than idling or stopping and starting engines (see diagram above). The use of such a system may greatly reduce unnecessary fuel consumption and mechanical wear. Building integrated solar panels (left and below left) also helps to offset the facility's energy usage.

Above, a central atrium skylight illuminates the core of the administrative and community space level of the facility. This simple element reduces energy consumption while improving work conditions and the experience for visitors.

TGE Cogeneration Facility, Greenpoint, New York

Energy Case Study Three



Photovoltaic panels and other forms of "alternative energy" technologies are proposed as a part of the facility for both energy and educational purposes. In the south elevation above, solar panels wrap the emissions stack to demonstrate how building surfaces can be augmented to produce energy in the city and also begin to transform the negative image of the stack itself. The combination of such technologies on-site, in conjunction with research laboratory space, makes the TGE facility a place for innovation in energy rather than simply a producer of energy.

The TGE Facility uses a combined cycle cogeneration energy system which is approximately 76% efficient through the use of waste heat recovery systems. The use of attached greenhouse structures (above and below left) expands upon the efficiency further by capturing even more waste heat which is typically lost through a building's walls and roof. Captured CO2 emissions from the facility increase horticultural productivity within the greenhouses similar to the Pernis Oil refinery in the Netherlands which diverts up to 8% of its emissions to 500 greenhouses.

One concept investigated for the greenhouses is to create a large experiment on biological carbon sequestration which investigates the use of algae that can absorb carbon dioxide (above). In some studies the algae is converted into a biofuel as an alternative energy source. The TGE facility can provide the CO2, heat, water, electricity and space for such research on-site.

PUBLIC ACCESS:

-EDUCATION
-BUSINESS
-RECREATION

What are the opportunities for inviting the public to the facility?

- Promote an understanding of the crucial role infrastructure has in the support of the community by making it visible instead of disguising it.
- Plan new infrastructure with public parks and walkways to encourage visitors.
- Make sites visible to help citizens understand the interconnection between the services they depend on and their daily lives.

What are the benefits of bringing the public to the facility?

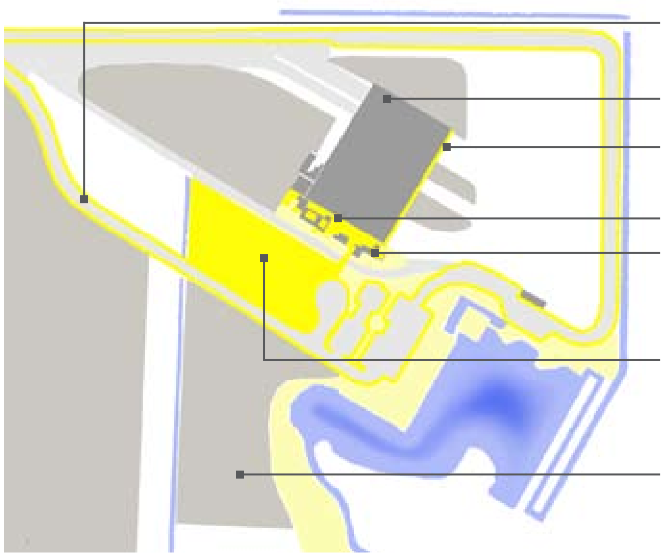
- Impact people's perception of the facilities and aid in the siting of future facilities by conducting educational programs on-site directed towards school children.
- Enable public interactions with infrastructure facilities to demonstrate synergies and the multiple uses of these places and their potential to be amenities to enhance the social, environmental and economic aspects of the community.
- Encourage transparency and public participation to ensure better management and compliance with regulations and best practices.
- Raise awareness about conservation and the environment through educational programs.

How can infrastructure enhance the vitality of local communities?

- Integrate educational opportunities for all ages into the facilities.
- Investigate and respond to needs for community services and public meeting spaces.
- Provide both passive and active recreational facilities wherever possible at the facility.
- Identify small business opportunities related to the facilities, products, waste, energy and community programs.

Solid Waste Transfer and Recycling Facility, Phoenix, Arizona

Public Access Case Study One



Separation of visitor and employee roadways is designed to reduce traffic conflicts with large trucks

Facility sited and designed with community input and artists' participation

Walkway along main sorting floor allows visitors to see internal facility operations

Amphitheater outdoor classroom area

Office space for building operations and associated nonprofit groups such as recycling partners and Phoenix Clean and Beautiful are an integral part of the building's public amenities

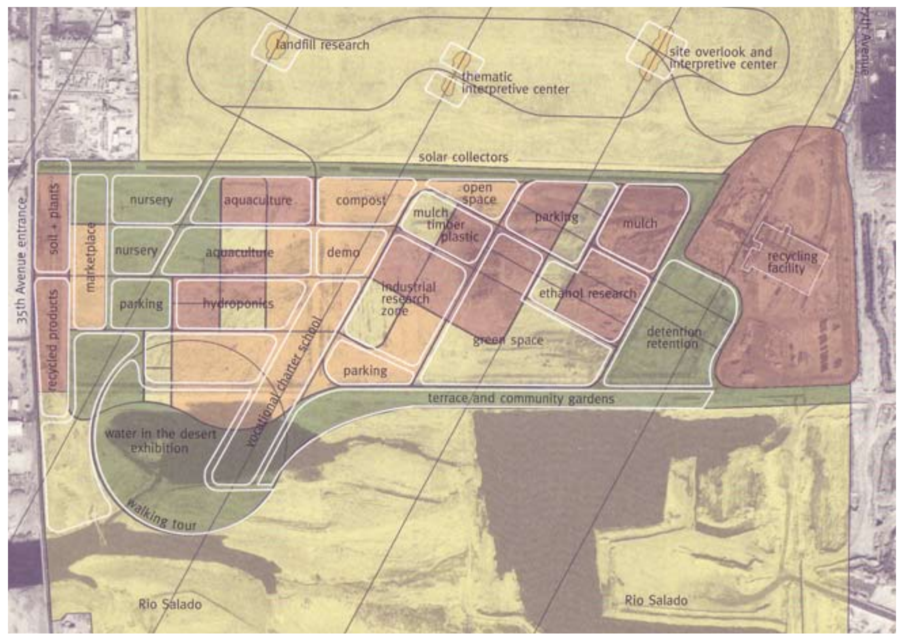
Self-haul location, Salvation Army drop-off, materials recovery and composting bring the community into the site while reducing the burden to the waste management system

Facility systems designed to act as a catalyst for the surrounding community through CELE (see below right)

The Center for Environmental Learning and Enterprise (CELE) site is proposed as an adjacent eco-industrial park meant to operate in conjunction with the 27th Avenue Solid Waste Management Facility (see plan below). The existing facility acts as an incubator and anchor providing an abundance of recycled paper, plastic, metal, glass, mulch and energy from the landfill. CELE encourages industries to coexist on the site with a mutually beneficial common goal to minimize waste, pollution and natural resource depletion. The criteria for choosing enterprises at the site include their potential to participate in synergistic and possibly closed-loop material and energy exchange systems.

CELE not only creates increased public access and awareness; it seeks to build new local businesses and create jobs while reclaiming brownfields and protecting the environment.

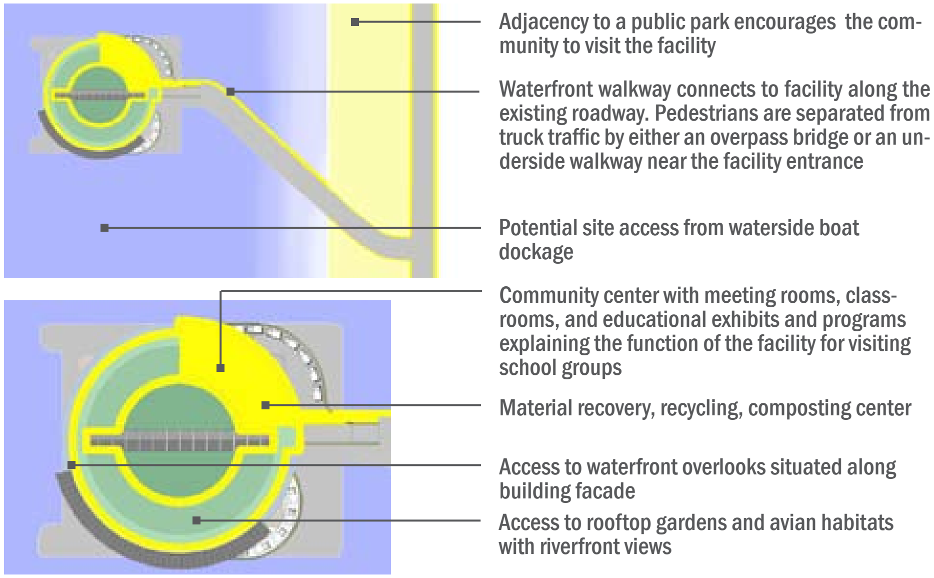
The Waste Transfer and Recycling Facility's design focuses on transparency and access with the goal of allowing many views and experiences of the building and its processes. The pedestrian walkway (above right) creates views into the depth of the facility operation with interpretive displays. The amphitheater space (above left) is a larger gathering space with a direct view of much of the active sorting machinery and other kinetic processes.



The Center for Environmental Learning and Enterprise (CELE) concept master plan.

Marine Transfer Station, Manhattan, New York

Public Access Case Study Two



The proposed Marine Transfer Station interacts with the public in multiple ways. Most importantly, trucks can be stored within the building itself—opening up valuable waterfront land. Just as waterfront improvements like the Hudson River Park piers (above) have the potential to revitalize communities, so could an MTS with adjacent parkland. In addition to parkland, the facility itself incorporates open spaces and access to waterfront overlooks and rooftop gardens (see below). Lastly, some functions of the facility itself such as bulk recycling, battery drop-off and material recovery, invite the public to visit the facility.

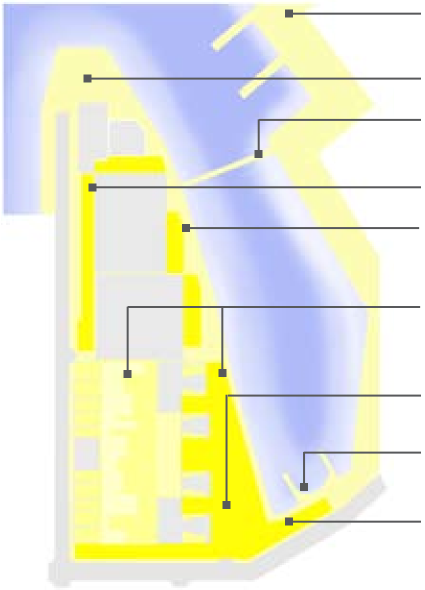
The MTS incorporates a material recovery and exchange center. These are becoming more common and desirable in communities. Architectural salvage and Salvation Army drop-offs and thrift stores can encourage more public interaction with the facility. Drop-off and exchange hours should be limited to nonpeak truck traffic hours to avoid traffic conflicts.

The MTS's green roof is accessible by the public for viewing the sights and creating community gardens. People wishing to establish nonedible gardens can use the compost and collected rainwater available on-site. Pictured above is a green roof on a school in Reykjavik, Iceland.

Pedestrian walkways, overlooks, and fishing piers are designed along the building exterior. Such walkways and overlooks allow visitors to view the waterfront as well as look into the inner workings of the facility.

TGE Cogeneration Facility, Greenpoint, New York

Public Access Case Study Three



Marina established on Bushwick Inlet for waterside public access to surrounding park

Waterfront park along the East River

Waterfront park along Bushwick Inlet with pedestrian bridge linking the north and south sides

Existing industrial building retained as artists' studios

Public access along building perimeter (where possible) creates access and increased security through "eyes on the park"

Green roofs, greenhouses and native plant nurseries function off of the building's waste heat and water to create new local green industries

Community resources building provides meeting rooms, artists' studios and performance spaces

Historic site of the Civil War Monitor Boat Yard restored and Civil War Museum built as a part of site renewal

The primary facility facade along Kent Avenue is faced with offices, greenhouses, a museum and an environmental charter school to create an open and inviting public face (see below right)

The large greenhouses connected to the TGE Cogeneration Facility exterior walls will provide ample operating space for hydroponic and aeroponic gardens (for community and business use), laboratories for wetland plant cultivation and research. The greenhouses will also provide water filtration and storage, air filtration and biological CO_2 sequestration, while functioning as an educational and research asset for the community.

In addition to the greenhouses, office space, a school and a museum are proposed along the building's main public facade. These programs all benefit from free heat and electricity and some spaces will have excellent waterfront views. Businesses such as "hot yoga" and therapeutic spas are also encouraged to establish operations on-site due to the access to free heat.

The Blue Lagoon in Iceland is a famous geothermal spa which was built as the retention pond for a geothermal power plant's excess hot water. The facility's waste heat and water are used as a large public pool and spa. Such examples demonstrate how infrastructure systems can create community benefits. The geothermal power plant can be seen in the middle background.

From the street level the facility's public programs are incorporated into the building's transparent facade. The multiplicity of uses and activities seek to complement and enhance the streetscape.

PUBLIC ACCESS

WATER MANAGEMENT:

- FILTRATION
- REUSE
- RESPONSIBILITY

How can a facility conserve water through the use of non-potable sources?

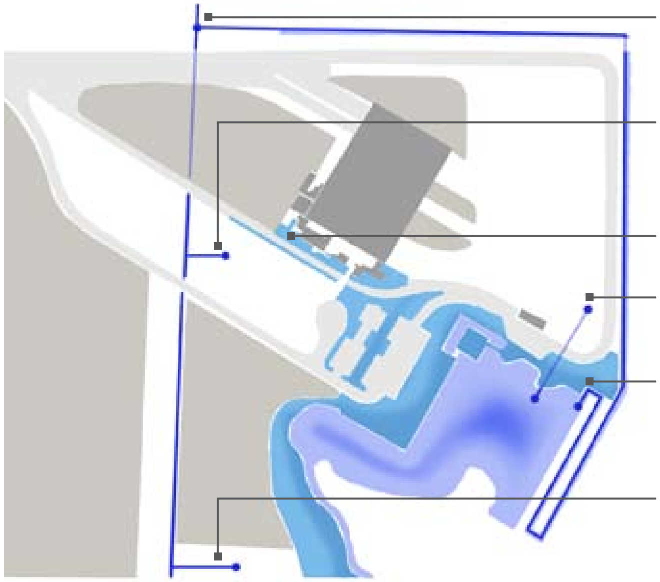
- Identify facility functions which may use non-potable water in place of potable water.
- Locate nearby sources of nonpotable water such as gray water and reclaimed water (see glossary for definitions).
- Perform a site analysis that identifies all the nonpermeable surfaces of the facility and site. Calculate the amount of yearly stormwater runoff from the site and compare with water demands of the facility. Provide storage for the stormwater runoff as a source of nonpotable water to meet those demands.
- Identify adjacent facilities or community needs for use of any clean wastewater or excess stormwater runoff produced by the infrastructure facility.

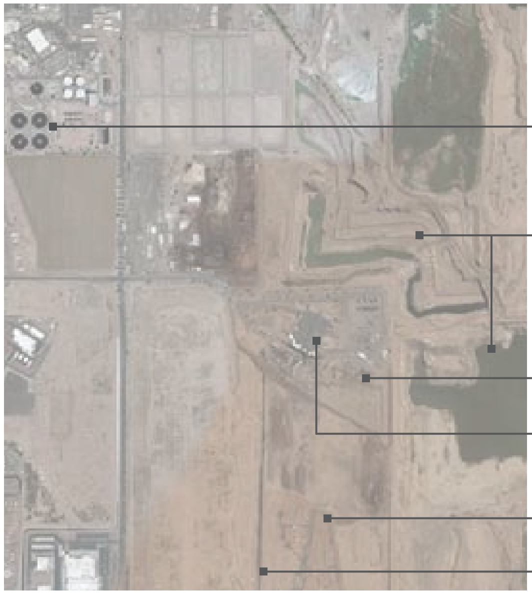
How can an infrastructure manage water use to ensure the health of its watershed?

- Prevent any untreated or unfiltered water from entering the watershed. Include water cleansing and filtration systems as landscape functions and building functions for use on-site.
- Design edge condition strategies for the release of water into existing watersheds.
- Identify multiple facility uses that can benefit from on-site water reclamation such as agriculture, habitat creation and garden features.
- Naturalize the edges of retention ponds and existing water bodies to provide water filtration and habitat enhancement.

Solid Waste Transfer and Recycling Facility, Phoenix, Arizona

Water Management Case Study One





Above, the landscape design of the facility uses all native and xeriscape plants to reduce water consumption. Where irrigation is needed, reclaimed water is used rather than a potable water source.

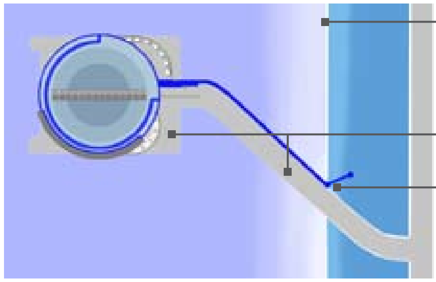
Sensitivity to water consumption is a major consideration for any new facility in the Southwest. Accordingly, the Solid Waste Transfer and Recycling Facility was originally designed to link the nearby wastewater treatment plant and its effluent discharge canals (middle below) with the Salt River through a series of built wetlands (bottom right). Although largely an effort to ecologically regenerate a segment of the degraded river, this water system also acts as a source of non-potable water for the facility for use in toilets, cleaning the main operations floor, washing trucks, composting, and future biomass operations. Recycled tertiary wastewater would also provide the CELE eco-industrial park (see Public Access Section) with water supplies for all of its main operations.

Tertiary treated water from the nearby wastewater plant (above) is carried along the landfill to cotton fields to the west. Re-use of some of this water locally may help to regenerate the Salt River and reduce the use of potable water for facility operations.

WATER

Marine Transfer Station, Manhattan, New York

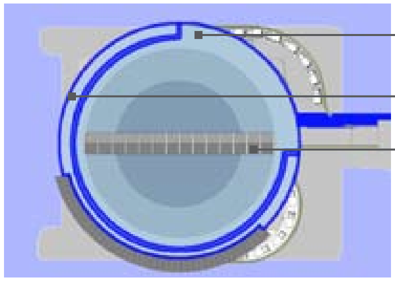
Water Management Case Study Two



Truck storage can be moved inside the facility allowing the creation of parkland and reconstruction of the seawall as a sloped and naturalized edge to encourage ecological regeneration and stormwater filtration (see below)

Use of existing infrastructure reduces the impact of new construction on the Hudson River

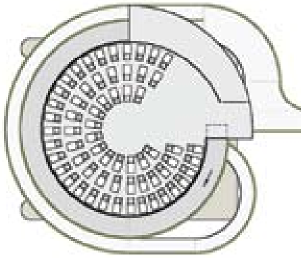
Stormwater collected on-site is used to clean trucks; any remaining gray water or excess stormwater is used to irrigate nearby parkland for a goal of zero water discharge



Stormwater is collected and treated; gray water is stored within rooftop wetland and within wall cavities

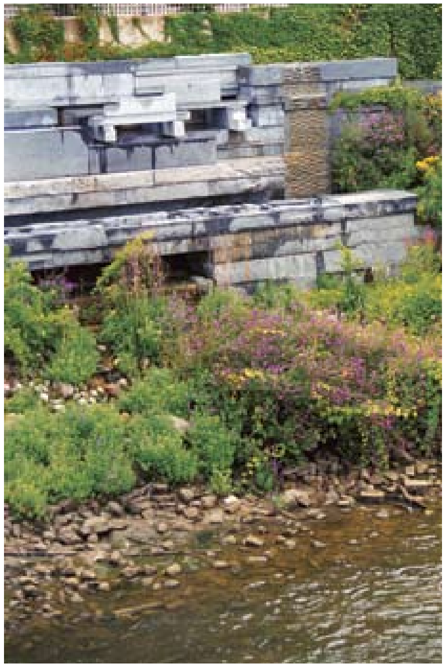
Gray water is treated through a "living wall" perlite planter box system along the building's facade

Photovoltaic panels are used to pump water to various locations for storage and use within the facility; water pumping is an efficient use of energy produced by photovoltaic panels



Left, an interior diagram of proposed truck storage within the MTS facility. Truck storage within the facility creates additional adjacent outdoor open space for public use.

Waterfront edges are valuable real estate in both financial and ecological terms. Because so much infrastructure and industry were historically (and in many cases currently) built along waterfronts, public access to the water has been limited. The ownership of these waterfronts has favored the construction of vertical bulkhead walls and the removal of all vegetation, often leaving sterile and lifeless edges where critical benthic and fish spawning habitat normally occurs. Redesigning these edges with sloped rip-rap (large stone), vegetation and mitigated outfalls can have a significant ecological benefit for the health of the entire regional water system. The flood wall in Grand Rapids, Michigan, by Michael Singer (right) is a good example of how vegetated edges that support habitat can be built within the urban environment.



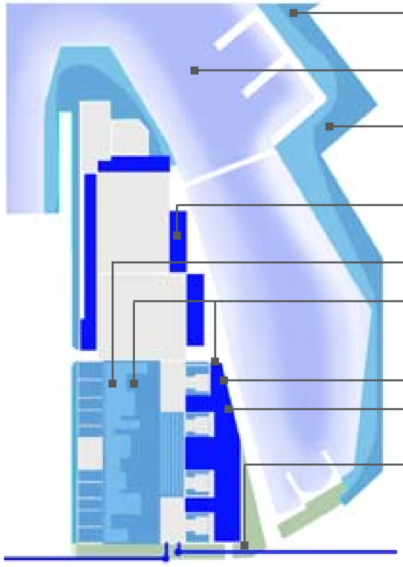
There are several approaches to passive water management within the design of the MTS building. The large green roof retains a body of stormwater for irrigation and for use within the facility for cleaning the trucks and the main operations floor. This rooftop garden also functions to filter water and provides avian habitat (see example below).

Because the facility is designed to store trucks within the building, the waterfront edge formally used to store trucks can become an active and ecologically regenerative vegetated edge (see below left).

Through design and engineering, ponds may be constructed as a part of rooftop gardens. The BMW rooftop water garden in Dusseldorf, Germany by ZinCo (above), was built to create wildlife habitat as well as cool outdoor spaces for meetings and informal gatherings.

TGE Cogeneration Facility, Greenpoint, New York

Water Management Case Study Three

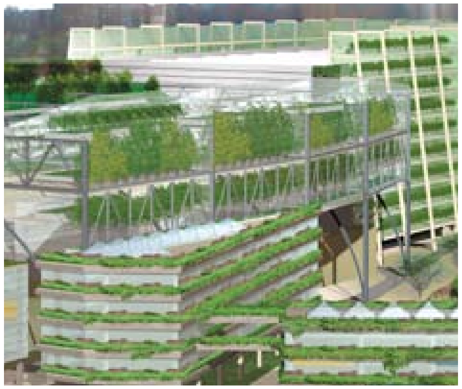


- Stormwater collected on-site and gray water produced by the facility is used for local irrigation of parkland
- Restoration of the Bushwick Inlet, which is currently polluted and degraded
- Creation of new parkland increases permeable surface area along the waterfront and the potential for naturalized sloped edges for ecological regeneration of the inlet
- Air-cooled condensers reduce the amount of water consumption and hot water discharge into the East River
- Rooftop cisterns supply gravity-fed irrigation systems
- Green roofs, greenhouses and native plant nurseries function off of stormwater collected from the roofs and from the building's wastewater to create new local green industries
- Wetland plant nurseries filter gray water within the facility
- Gray water used for algae-based CO_2 sequestration and biomass energy production prototypes
- Access to non-potable water from facilities such as the Newtown Creek Water Pollution Control Plant (see Site Context section) or subway dewatering pumps in Brooklyn can reduce or eliminate the need for potable water to operate the facility

The plan above is for the AES Cogeneration Facility in Londonderry, New Hampshire, by Michael Singer Studio and Blackbird Architects. This facility was sited, designed and built based on the infrastructural connections including a direct line for nonpotable water from the nearby Manchester Water Treatment Plant and a steam interface with an adjacent Stonyfield Yogurt Plant. These connections were critical to ensure the conservation of potable water and the protection of natural water resources. The infrastructure right-of-ways also formed a framework for habitat corridors and trails.

Above, greenhouses at the Alterra Institute for Environmental Research in Wageningen, the Netherlands, by Behnisch and Partner and Michael Singer. Greenhouses add natural light, filter water and help to support the office climate control. A greenhouse skin wrapping the power facility offers similar benefits. Excess wastewater, heat and energy sources all create ideal conditions for hydroponics, CO_2 sequestration research, community gardens and educational labs.

The primary water management goals of the TGE facility are to use little or no potable water for its operations, to discharge as little heated water into the East River as possible and to filter and reuse any water collected on-site. Together, these goals greatly reduce impact of the facility on water resources and potentially force older power facilities offline to reduce water consumption and pollution.



Water collected on-site by green roofs and impermeable surfaces is filtered through wetland plant nurseries and as needed through biological filtration systems (see above). The wetland plants are then harvested to supply plant material for local restoration projects. The TGE facility also provides an educational laboratory for research and supplies a resource for local colleges and universities that are in need of greenhouse laboratory space.

Left, a detail of the TGE facility with green roofs, greenhouses and planted terraces which work as a system to collect and filter on-site stormwater.

ARCHITECTURAL DESIGN:

-AESTHETICS
-FUNCTION

How can architecture reveal and interact with the function of a facility?

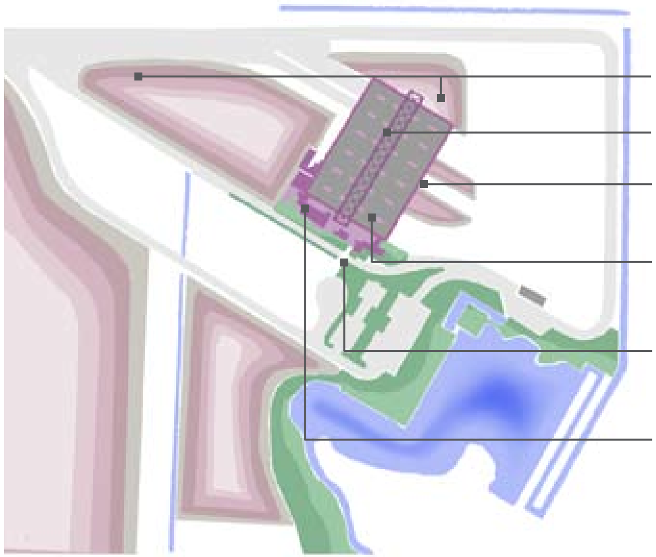
- Design of the facility needs to address its function. The beauty of a facility is in revealing its function as a key element of the architectural language.
- Avoid designing a facade that conceals or disguises the facility and can inhibit public understanding of the place.
- Mitigate the large scale of infrastructure facilities by including multiple interactive programs for community uses, small business and research needs, educational facilities, energy conservation and generation, water cleansing, and facility traffic and circulation needs.
- Maximize the design opportunities for natural air circulation, light penetration, solar energy generation and water collection.
- Locate dynamic and safe walkways and areas for visitors to view and understand the facility.
- Provide for improved facility management and working conditions through the use of natural light, transparency, plantings, and sound attenuation,

How can the architecture of infrastructure enhance aesthetics and challenge formulaic expectations?

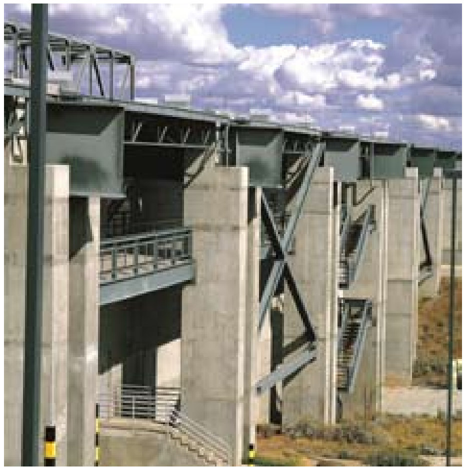
- Respond to the specific characteristics of the site rather than rely on predesigned, one-size-fits-all, typical structures.
- Provide appropriate budgeting for architectural design and community amenities as a recognition of the importance of infrastructure design in our civic realm.
- Account for the nontangible expenses related to public opposition, lengthy approval processes and court battles. Relate those expenses to the cost of building acceptable and desirable infrastructure the public will support.

Solid Waste Transfer and Recycling Facility, Phoenix, Arizona

Architectural Design Case Study One



The Solid Waste Transfer Station and Recycling Facility is designed to merge with its surroundings through the use of simple architectural forms such as terraces, courtyards and a varied massing of the building's primary public facade (above). The large truss structure provides for a flexible and adaptive interior while also creating a symbol for the building that can be seen from downtown. The City of Phoenix has built a piece of infrastructure that the community has embraced. In 1993, the New York Times honored the facility as one of the top eight "Best of the Year" architectural designs.

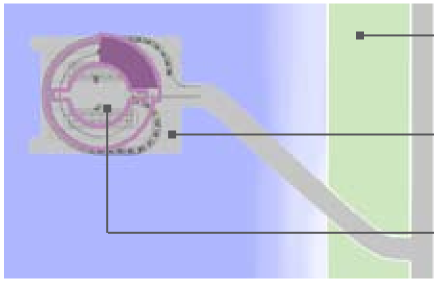


Many of the details that reduce the building's bulk and mass on the exterior also function to bring natural light into the building interior. Above left, clerestory frosted panels, skylights, glass block, and small operable windows are placed throughout the facility. Above right, the building's structure is expressed on its exterior.

The facility is designed as a humane and inviting structure, a place for the City of Phoenix to be proud of rather than a place to be hidden from public view. The design increases natural light for laborers and office workers.

Marine Transfer Station, Manhattan, New York

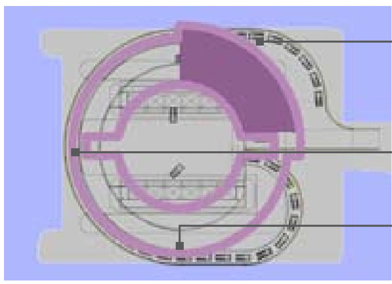
Architectural Design Case Study Two



Adjacent park area used to visually enhance views of the facility from afar

Reuse of existing road and staging areas to reduce the impact and cost of new construction

Green roof provides aesthetically pleasing views from surrounding tall buildings



Automated circular ramp system designed to reduce truck queuing and idling time to improve circulation and reduce health impacts on both the work areas and surrounding environment

Circular form breaks traditional infrastructure box form but relates to the functional turning radius of a garbage truck

Exterior green walls and layered vegetation are used for water filtration as well as providing a buffer for noise and air pollution

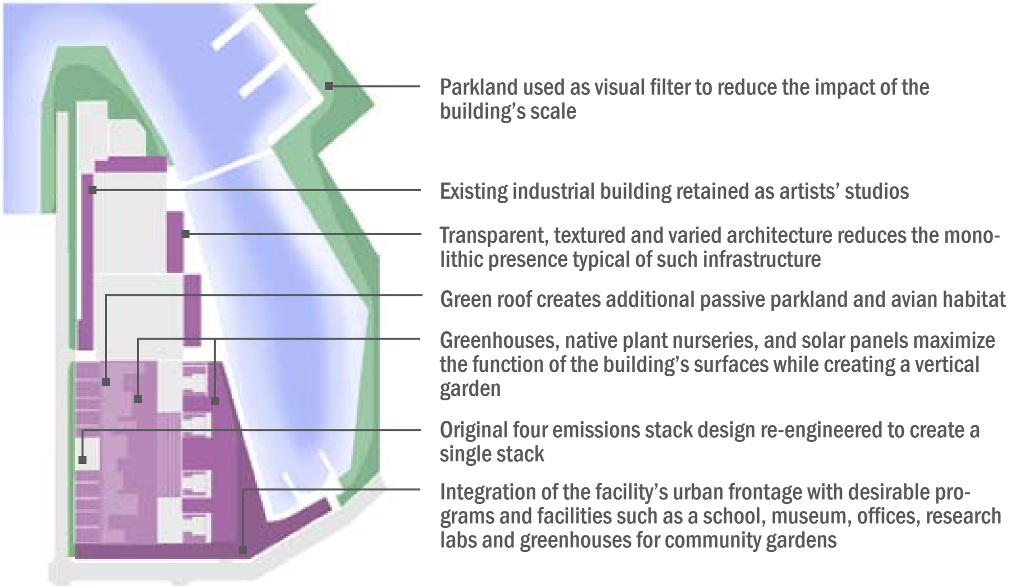
Massive buildings and infrastructure can be softened and even made beautiful through the use of climbing and cascading plants. Such "hanging gardens" are proposed along the cylindrical rings of the MTS facility (above) in order to screen views of the trucks while filtering air and water and reducing noise.

The cylindrical form of the MTS structure creates efficiencies in the queuing and storing of trucks within the facility, which is a departure from the standard infrastructure box. In this way the form reveals the function of the facility and has the potential for unique lighting and color.

Above, a parking garage in Miami Beach, Florida, uses metal mesh and vegetation to cover the structure completely while filtering air and water through its planters. Large areas of vegetation in urban environments help to mitigate the heat island effect, provide bird habitat, cut down on the grit and grim of urban areas, and help reduce CO_2 and other air pollutants.

TGE Cogeneration Facility, Greenpoint, New York

Architectural Design Case Study Three



Above, an elevation of the TGE facility with a variety of greenhouse enclosures, transparencies and layered vegetation. Every surface of the building has a potential to support and express environmental function while creating a completely new aesthetic for power facilities. The large glass enclosure can be created as a single transparent curtain wall similar to the convention center in Germany shown top right.

The TGE facility is designed with a transparent, colored and textured skin to break up the monolithic mass and facades typical of such power plants. The primary goal is to create a facility that inspires curiosity about the various horticultural, research and educational activities occurring within these transparent exterior spaces (below left, above). The secondary goal is to transform negative associations the public carries towards the usual and expected design of these facilities.

Simple use of color and articulated mass can transform the feel of large structures. In the daytime colored panels reflect light and break up large surfaces of building mass. In the evening the building form may be altered through the interplay of darkness and light such as at the Tyseley Energy-from-Waste Facility in Birmingham, England (above). Light installation by artist Martin Richman and architect Ray Perry.

AFTERWORD

America's aging and overloaded infrastructure badly needs the civic version of "Extreme Makeover" to secure vital services, economic growth and a decent quality of life for current and coming generations. Most transportation and public works facilities are not "in ruins," as some pundits insist, but decades of deferred maintenance and minimal "patch and pray" improvements have quietly eroded system performance in many places and increased the risk of malfunctions and cascading failures that can swiftly radiate throughout the built and natural environments.

Complex new demands and volatile demographic, economic and environmental conditions are also straining legacy systems in ways never imagined by their original designers and builders. For example, the U.S. population is growing noticeably bigger (300 million and counting), older and more mobile; our economy is in the midst of a wrenching metamorphosis fueled by rapid advances in information and communication technologies and globalization; a warmer and more restive climate has increased the threat of devastating storms in coastal areas and the pressures on scarce resources in all regions; and finally—as if all that weren't enough—infrastructure facilities have become high value targets for ongoing domestic terrorist plots. Welcome to the 21st century…

Prospective makeover teams face much tougher tasks than the brave souls who built the original facilities. For example, the public—outside the immediate stakeholders—rarely pleads for infrastructure upgrades in the first place; in fact, many actively oppose the process, especially if it takes place in or near their neighborhood. Once upon a time, people were eager to get water, sanitation, power, transportation, drainage or telecommunications services just as fast as possible—even if the process took a generation or more to fulfill. At least their kids would avoid water-borne diseases like cholera, the stench of garbage, sewage and animal wastes, unreliable drinking water, recurrent flooding, isolation and the grinding poverty and toil that shaped so many American lives only a century ago.

To be fair, early infrastructure planning and siting practices were often ham-handed and profoundly disruptive, especially to adjacent communities and neighborhoods with little political or economic power. The only saving grace was that all residents eventually got access to the same set of services, but some were forced to put up with the bulk of negative side effects associated with their production and delivery. These inequities created a lingering distrust that is still palpable and understandable today—especially in the face of new proposals to update and expand existing facilities on or near their original sites.

Environmental Defense and Michael Singer Studio have made a bold and timely effort to redress this imbalance and support local efforts to address future infrastructure needs. They do so by challenging the civil engineering orthodoxy that still favors drab standardized designs and the unspoken belief that such facilities have little symbolic importance to the communities they serve. "Hey, it's just a garbage (sewage treatment, sludge removal, power, etc.) plant…. Who cares what it looks like?"

The examples presented in this paper—both real-life and proposed—show how typically reviled facilities can be transformed into enthralling and fully functional works of art that strengthen adjoining neighborhoods and ecosystems. Instead of conventional mitigation strategies that merely mask negative side effects, they suggest inventive ways to reduce or eliminate them. In place of chain-link fences festooned with razor wire and “Keep Out” signs, these facilities wholeheartedly welcome the public by incorporating attractive amenities, gathering places and a host of recreation, education and job development opportunities. Rather than operating as impenetrable single-purpose silos, they promote transparent and integrated approaches to production, resource management and service delivery throughout the urban area. In short, these examples serve as dynamic touchstones for next generation infrastructure design.

A big marine transfer station may not be considered the ideal next-door neighbor in a residential or mixed-use area. Nevertheless, to the extent that it consistently adds needed value, performs a vital function for the whole community and becomes a potent symbol of environmental stewardship and a dazzling landmark to boot, it may start to overturn old prejudices and develop an ardent following of its own.

Of course, any alternative approach must undergo rigorous financial and engineering analyses before it can be incorporated into the public realm. All the standard questions about cost, safety, quality and reliability of service, economic, social and environmental impacts, etc., are still valid. These questions, however, need to be augmented with a long-term holistic perspective that builds in sufficient flexibility to respond nimbly to the dynamic economic, demographic and environmental conditions facing cities. In addition, building facilities that strengthen and support local neighborhoods and are well received by them, reduce the cost of litigation and delays and enhance the linkages between infrastructure and the people it serves.

The inventive and multifaceted designs put forth by Michael Singer Studio may seem more costly than conventional solutions but this presumption is not always correct. In fact, the Phoenix example provides solid evidence that attentive design can save money and a host of unforeseen problems over the life of the project. The key lessons are: 1) engage a broad range of creative disciplines; 2) draw on the wisdom of the neighborhood in support of the process; 3) always challenge assumptions; and 4) work with prevailing conditions and constraints.

This document is just what is needed right now to get local leaders, community activists and citizens excited and energized about rejuvenating critical infrastructure systems in their own backyards. Fearless designers with plenty of talent and insight should roll up their sleeves and join the fray.

Nancy Rutledge Connery

GLOSSARY

Automated Queuing System: A mechanical conveyor that transports trucks without drivers and with their engines turned off.

Brownfield: A disturbed and heavily contaminated stretch of land.

Community Benefits Agreements: An enforceable, legally binding contract that requires large scale developments to provide benefits to the local community.

Dialogue: An extended conversation with defined terminology and open minds.

Ecological Regeneration: Returning biological function to a place.

Embodied Energy: The total energy used in the manufacturing of building materials and components.

Energy Networks: A connective system of energy producers and consumers.

External Economic Benefits: Positive outcomes outside of traditional business models that do not directly profit the primary business.

Formulaic Infrastructure Design: An approach that uses a universal model regardless of place.

Green Roofs, Terraces and Walls: Architectural surfaces that are fully or partially covered by plant material.

Green Space: Any area where positive ecological processes are encouraged by design.

Gray Energy: The energy used to transport construction materials to the site.

Gray Water: Nonpotable nontoxic excess water from human activities.

Habitat Creation: The generation of space for plant and animal communities.

Induced Energy: The energy used in the construction of a facility and associated infrastructure.

Integrated Solar: An electrical production method that incorporates photovoltaics by attaching or embedding them into the architecture of a building.

Marine Waste Transfer Station: A place where waste is loaded onto boats and shipped away from the immediate area.

Material Recovery: The process of extracting usable material from waste.

NIMBY syndrome: “Not in my backyard”; A social condition whereby people want the benefit of something but object to its physical presence.

NonPotable Water: Water unfit for human consumption but fit for other purposes (see Tertiary Wastewater, Reclaimed Water, Gray Water).

Operational Energy: The total energy used in the daily operations of the facility to perform its designated function.

Reclaimed Water: Collected stormwater, tertiary wastewater and/or gray water for non-consumptive use.

Redundant Networks: Two or more systems that perform the same function.

Regenerative Design: Design that goes beyond sustainability by creating an evolving system that seeks to improve the environment and socioeconomic conditions.

Regenerative Network: A new model that integrates economic, social, and environmental concerns for the design and planning of infrastructure in order to achieve a regenerative system.

Stormwater: Water caused by precipitation.

Tertiary Wastewater: Water that has been partially cleaned and requires a final treatment before being released into the environment.

Top-Down Approach: A method of project management and design that does not incorporate suggestions from outside the chain of command.

Waste Heat: Excess heat generated by energy production.

environmental defense

finding the ways that work

National Headquarters
257 Park Avenue South
New York, NY 10010
212-505-2100

1875 Connecticut Avenue, NW
Washington, DC 20009
202-387-3500

3250 Wilshire Boulevard
Los Angeles, CA 90010
213-386-5501

5655 College Avenue
Oakland, CA 94618
510-658-8008

1107 Ninth Street
Sacramento, CA 95814
916-492-7070

2334 North Broadway
Boulder, CO 80304
303-440-4901

18 Tremont Street
Boston, MA 02108
617-723-2996

4000 Westchase Boulevard
Raleigh, NC 27607
919-881-2601

44 East Avenue
Austin, TX 78701
512-478-5161

Project Office
East 3-501
No.28 East Andingmen Street
Beijing 100007 China
+86 10 6409 7088