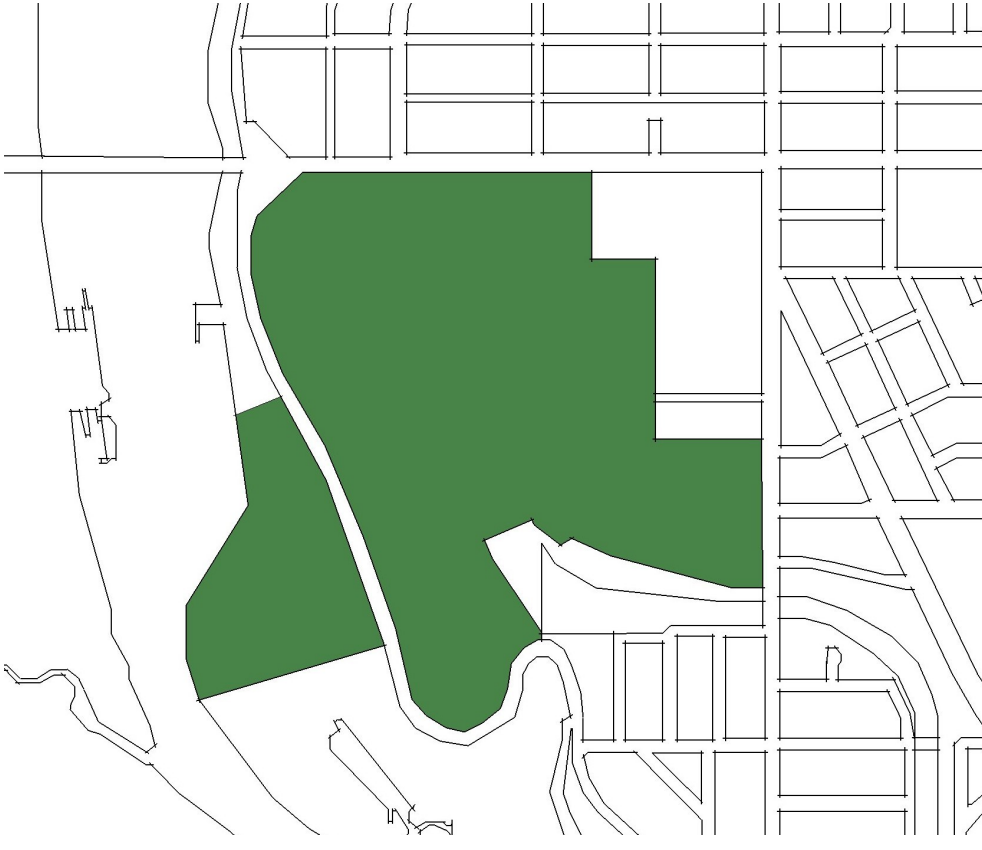

Roadmap to Sustainability

Saint Paul Ford Site

SAINT PAUL
The Most Livable City in America

Minnesota Pollution Control Agency

Ford Site Sustainable Redevelopment Report

by the City of Saint Paul Ford Site Sustainable Redevelopment Team

Updated May 2, 2011

Acknowledgements

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Loren Abraham, Abraham and Assoc. Architects and Adjunct professor at U of MN College of Design
John Carmody, Director of Center for Sustainable Building Research in the U of MN College of Design
Ken Haberman, Landmark Environmental
Peter MacDonagh, Kestrel Design Group
Peter Musty, PETER MUSTY LLC
Richard Strong, Adjunct professor and research fellow at Center for Sustainable Building Research, U of MN College of Design

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Barbra Batshalom
Tova Greenberg
Jacob Knowles
Dee Spiro

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City of Saint Paul staff:

Merritt Clapp-Smith
Emily Goodman
Joe Musolf
Luis Pereira
Dennis Rosemark
Kurt Schultz

MPCA staff:

Laura Milberg
Philipp Muessig
Tim Nolan

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Jay Gardner
Roger Gaudette

Table of Contents

Executive Summary

The following pages lay out an aggressive sustainable redevelopment agenda for the Ford site and mechanisms to move the agenda forward in cooperation with policy makers, site developers and the community.

This report is the culmination of eight months of work and meetings with the Ford Site Sustainable Redevelopment Team (see Acknowledgements). The team's mission, as defined by the City of Saint Paul (the City) and the Minnesota Pollution Control Agency, was to identify, research, and move forward a sustainable redevelopment platform for the Saint Paul Ford site. A related effort, a sustainable stormwater feasibility study for the Ford site, was done by a consultant team from Barr Engineering and culminated in a companion report, the Sustainable Stormwater Feasibility Report for the Ford Plant Site.

Sustainable redevelopment of the 144-acre Ford site is a high priority for the City, regional and state agencies, the Ford Site Planning citizen task force, and much of the public. This site offers an unparalleled opportunity in the Twin Cities to redevelop a large piece of land in the heart of a vibrant and successful neighborhood and adjacent to the Mississippi River and to do so in a way that respects the history and context of the neighborhood, while designing a thriving community that significantly lowers its impact on the environment. A redeveloped Ford site can demonstrate that residents, employers, workers, and visitors can enjoy all the amenities and comforts of modern living while using much less energy, producing clean energy on site, reducing waste, reducing and treating storm-water runoff, restoring a natural ecosystem, and providing an infrastructure system that reduces vehicle trips and encourages walking, biking, and transit.

The ultimate goal of this report is to recommend performance thresholds for site redevelopment, inspiring policy makers and developers to make this site a national model for sustainable brown-field redevelopment.


1032 ft
Image U.S. Geological Survey
©2010 Google
Imagery Date: Mar 31, 2006
44°54'36.18" N 93°11'56.12" W elev 702 ft
Eye alt 4384 ft

Sustainable Redevelopment of the Saint Paul Ford Site: Eight Findings

The following section describes in eight findings how sustainable redevelopment is a priority for the Ford site, the site's unique potential, and how market forces may be captured to maximize the potential for sustainable redevelopment.

1

Sustainable redevelopment of the Ford Site is a municipal priority.

The Saint Paul Ford site has an important role in the City's history and development. In the early 1920s, the property was acquired and developed by Henry Ford, inspired by his interest in using hydroelectric power from the Mississippi River to power the plant. Ford negotiated to purchase the planned hydro facility and moved forward on a grand vision for the new plant, which included constructing a railroad line to the property, using barge shipping for some of the products, and mining silica from the sandstone under the site to use in glass production.

Ford's comprehensive vision and efficient use of the property using manmade and natural amenities was a precursor to today's vision for well planned and sustainable redevelopment of the Ford site, if the plant closes as announced. Saint Paul's Mayor Coleman, while regretting the plant's closure, has made clear that if the site redevelops, it should be done at the highest level of sustainability that is technically and financially feasible. He believes the site has the potential and the responsibility to be a legacy project highlighting the best examples of green design for mixed land uses, buildings, infrastructure, and open space and should strive to be a "zero emissions community". Social and economic sustainability depends on redeveloping a strong base of employment on site, as well as housing, businesses, and community amenities that serve a diverse population and complement what is already available in the Highland Park neighborhood.

The community is likewise interested in a strong level of sustainable redevelopment at the site. In 2007, the City worked with a

"There is compelling evidence that smart growth provides significant net economic benefits via avoided infrastructure costs, increased economic activity, reduction in household travel costs, job creation, public health improvements, energy and water use efficiency."

- Center for Clean Air Policy, from pending report titled "Growing Wealthier: The Economic Benefits of Smart Growth", 2009.

consultant team and a 25-member Ford Site Planning Task Force to evaluate a range of reuse options for the site, should the plant close. After many task force meetings, public meetings, stakeholder conversations, and assistance from a University of Minnesota Humphrey School graduate student team, green design and sustainability emerged as an overarching goal for the site. This is reflected in the Ford Site Planning Task Force's vision statement for the site:

> "The redeveloped Ford Site will balance economic, social and environmental sustainability in a way that conserves and improves the qualities and characteristics of the Highland Park neighborhood and Mississippi River Valley corridor in which it sits, while advancing the City's economic wealth and community goals, resulting in a forward-thinking 21st century development."

The Ford site has long been an economic anchor for Saint Paul – establishing a tradition of market driven innovation in manufacturing and production practice. Several converging realities are creating potential for Ford, Saint Paul, and the State of Minnesota to carry forward the local tradition of innovation and employment at the site, while striving for new ground in sustainability and green practices.

2

There is great potential to realize a demonstration project for the City and a legacy project for Ford.

Ford and the City of Saint Paul each are building legacies of leadership in sustainability. As of the writing of this report, there is emerging an unprecedented alignment of public and private sector interest in advancing innovation in sustainability technology and practice. This is true worldwide, nationwide, statewide and in Saint Paul at the Ford Plant. Stakeholders involved in planning for the site's future are developing parallel visions for long-range economic and environmental sustainability through innovation in practices.

Leading the way, the State of Minnesota has set a goal of 80% reduction in greenhouse gas emissions by 2050:

> "216H.02 GREENHOUSE GAS EMISSIONS CONTROL Subdivision 1. Greenhouse gas emissions-reduction goal. It is the goal of the state to reduce statewide greenhouse gas emissions across all sectors producing those emissions to a level at least 15 percent below 2005 levels

by 2015, to a level at least 30 percent below 2005 levels by 2025, and to a level at least 80 percent below 2005 levels by 2050."

The City of Saint Paul has set a shorter term goal of a 20% reduction in greenhouse gas emissions by 2020.

Specific to the Ford site, the City defines a sustainability agenda as follows:

"The City will work to ensure the three main components of sustainability – economic, social and environmental – are addressed in redevelopment of the Ford site....The Economic and Social components of sustainability may result in a development that:

- supports a diversity of people;
- includes a full range of housing types and affordability;
- creates meaningful public gathering spaces, both in and outdoors;
- adds a variety of businesses and services;
- provides a range of living wage jobs for a workforce with varying skills and education levels; and
- adds significant tax base to support high quality services for the community.

The Environmental component of sustainability may encompass:

- energy conservation in site and building design;
- alternative energy systems and onsite energy generation;
- low carbon emissions;
- waste reduction and recycling;
- best practice management of stormwater;
- a strong network of parks and open space;
- an emphasis on biodiversity;
- a street layout that supports biking, walking and alternative transportation;
- the inclusion of bike facilities, transit stops, car sharing, and other features to encourage car trip reduction."

- from City of Saint Paul website, August 2009, http://www.stpaul.gov/index.aspx?nid=2640

Furthermore, the City of Saint Paul describes how it's broadly achieving sustainability goals within the City:

"…With approximately three-quarters of US residents living in cities, our nation's future relies on the well-being of our cities. In turn, the well-being of our cities depends on making them sustainable, livable, viable, and vital. To this end,

The City of Saint Paul's goal for reduction of greenhouse gas emissions:

20% by 2020.

The State of Minnesota's goal for reduction of greenhouse gas emissions:

80% by 2050.

development must be balanced with the long-term health of the environment.

We are achieving our goals through strategies that proactively protect our city's air, water, and urban landscape. Those strategies include working with energy providers to reduce carbon dioxide emissions that both help the environment and produce significant costs savings; improving and expanding recycling service for residents and businesses; constructing green buildings that set the example for others in the city; retrofitting current buildings to reduce energy demand; focus on water quality; promote transit-oriented development as well as transit alternatives such as light rail and pedestrian friendly streets; and improve the water quality for the City's residents.

We promote use and respect of the environment by improving Saint Paul's system of parks, green spaces, bikeways, and trails…."

- from Sustainable Saint Paul, City of Saint Paul website. http://www.stpaul.gov/index.aspx?nid=2640

Perhaps most importantly, Ford has recognized and embraced the value of going green. In addition to "Economic Value" and "Community", one of Ford Land's three Guiding Principles for development is …

"…**Environmental Stewardship**…[to] build and manage environmentally responsible properties…" *- from Ford Land website., http://www.stpaul.gov/index.aspx?nid=2640*

3

The size of the site provides a unique opportunity to implement sustainable infrastructure at a neighborhood scale.

The Ford site is a great location to create a live-work-shop-recreate neighborhood utilizing renewable energy, low-impact water and waste systems, and street design techniques that demonstrate regionally and climatically appropriate neighborhood-wide applications.

1. The size of the Ford site provides **economies of scale** to pioneer affordable district-wide sustainable land practices involving water management, renewable energy, eco-industrial systems, etc.
2. The **location near so many universities**, colleges, educational institutions and forward-thinking utility companies, provides local access to expertise in green

building, carbon calculation, energy management, biological systems and stormwater management, as well as partnership opportunities to conduct efficient base-lining and documentation of pre- and post-redevelopment conditions and performance.

3. The **industrial history and tradition of the site and local workforce** is that of innovation in manufacturing and market-driven renewals in technology, craft, and manufacturing practice. There is a high capacity and a local commitment to retrain for green jobs and in green construction practices.

4. The land's **unique relationship to the Mississippi River** provides several geotechnical and water management opportunities to demonstrate ecologically sensitive urban development on a river bluff.

5. The **strong, surrounding Highland neighborhood** can be re-connected by this development. If the initial integrated urban design and ongoing public process is constructed correctly, the list of win-wins for the neighborhood can be surprising.

6. If new industry is introduced, there is **potential for Eco-Industrial principles to be applied**, capturing synergies during the creation of a new urban industrial district.

4

The development and redevelopment potential of the land is unmatched in the region.

The scale and location of the Saint Paul Ford site are unmatched in the region for redevelopment potential. Several qualities of the site enable it to perform well for a broad range of possibilities.

1. The land is set between the urban and the natural, between walkable urban neighborhoods to the north and east and the Mississippi River and Hidden Falls Park to the west and south.

2. The site is centrally located in Saint Paul/ Minneapolis, 10 minutes from each downtown.

3. There is easy access to bus, light rail transit, the airport, and medium freight/light industrial transport.

4. There is great access to social, recreational & cultural amenities such as biking, regional park systems, art, theater, schools, and community and retail services.

5. There is a high quality job training and education center on site.

5

The futures of the river bluff, the Ford site, Highland Village, and the surrounding neighborhoods are intertwined. Their infrastructure and eco-systems can be designed, constructed and managed in integrated ways.

There is a comprehensive list of local systems that can be re-imagined, restored, renewed or newly constructed, both on-site and district-wide, including: energy, water management, multi-modal transportation, natural habitats, and local food production.

There is a City and community vision for the site to include a mix of uses and high-quality jobs that will allow it to continue to function as an economic anchor and became a model of sustainable living for the entire region.

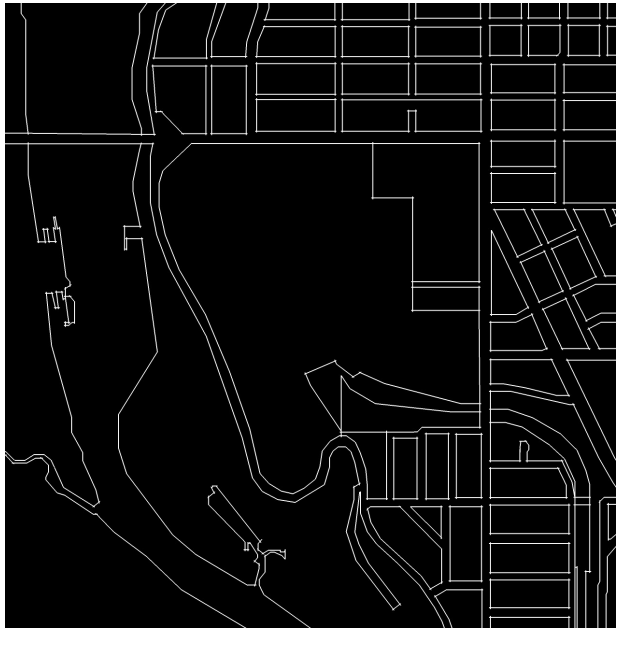
Each phase of site redevelopment can break down more barriers and allow the city to 'grow through' the site, extending a pattern of Saint Paul's traditional, reusable urban blocks carrying a stable mix of uses.

Non-residential development of the site can complement and augment the commercial and civic life of Saint Paul. Through regular coordination, it will be possible to allow the market to 'fill in the blanks' without creating imbalances or need for subsidy.

6

Now is the time to creatively plan for long term investments in sustainable infrastructure.

All stakeholders must recognize the limited window of opportunity to strategically coordinate city-wide, eco-industrial development synergies, renewable district energy systems and distribution, water systems, and transportation planning. These public–private synergies must inform the master planning, help set timing and strategy, and create financial leverage. For a project of this size to move forward with any efficiency in a slow absorption market, the developer must not be detached and remote, nor can the City afford a 'zone and hope' approach, leaving implementation of important city goals to the private sector. An early surge of coordinated design and planning between the land owner, the City of Saint Paul, and key stakeholders will take advantage of synergies and identify financial and technical tools to achieve them.



Business as usual?
Redeveloping the Ford site will take time, which provides a great opportunity to engage in a public-private development and implementation process that matches the sophistication and high standards of the project desired. Saint Paul can look to emerging best national practices as models for the process. Several ideas for integrated design and implementation are outlined later in this document.

7

We must allow dynamic market forces to operate freely, but only in support of a timeless, sustainable urban pattern.

How will the market for jobs, housing, retail and open space change in 2 years, 5 years, or 10 -15 years? Each of these land uses plays a vital role in an integrated and vibrant community. To sustain private investment over the span of redevelopment, it will be important to maintain some degree of flexibility as the development market changes. The size of the site will likely require early phases of redevelopment to proceed without a precise understanding of the final mix of land uses. Several things can be done to mitigate the lack of market predictability and allow for incremental investment:

1. **Form based regulation.** There will be a need to cooperate on setting parameters for the form and intensity of development, while making a permitted range of uses a secondary development parameter.
2. **Land use determinations should be market based and flexible within a range of permitted uses.** The City must understand that the real estate market will change at times very rapidly during the course of this development – perhaps within the course of a single phase.
3. **The public realm must be engraved clearly into a master plan.** Commitment to a clearly articulated long range plan for public realm and sustainable infrastructure will set in place some degree of predictability for private investment. This aligns with the City's long range responsibility, in Highland and throughout the rest of Saint Paul, to provide the highest quality sustainable public realm, energy, water systems, and environment.
4. **Smaller phases.** The scale and increment of the real estate market may drive smaller projects in land area and intensity. This holds an opportunity to redefine

redevelopment as a gradual, organic succession of small projects versus large, awkward, adjacent, but separate, phases. It may be smart to consider platting the land in smaller blocks, with smaller parcels than usual, to allow for incremental phasing.

5. **A modular, small blocks pattern allows for smoother land use transitions, short term market flexibility and easier long term reuse.** The traditional grid of smaller blocks with regular, modular parceling is contextual to the Saint Paul fabric, and will set up an economical succession of uses over time. Also, a 'small blocks' master plan, more than any other master plan technique, maximizes walkability.
6. **Water loads, energy loads and street design classifications may need to be designed for a wide range of uses.** Design infrastructure systems and capacity for shifts in demand, to enhance land use flexibility, and to ensure long-range viability.

8

Costs vs. Investments: Building to higher standards translates to higher paybacks.

It will be necessary to use financial, investment and development models that are as innovative as the design practices employed. Creative financing models can ensure that even small investors share in the benefits of investing in projects with long term paybacks. Several recent reports and research show that patient equity, smart planning and urban design, coding, integrated design (see page 44), investment in sustainable technologies, etc. provide a higher payback than conventional approaches.

Resources

- *"Back to the Future: The Need for Patient Equity in Real Estate Development Finance", http://www.stpaul.gov/index.aspx?nid=2640. The Brookings Institution, January, 2007. Christopher Leinberger, and*
- *Walking the Walk, How Walkability Raises Home Values in U.S. Cities, http://www.stpaul.gov/index.aspx?nid=2640, Joe Cortright, Impresa Inc., CEO's for Cities.*
- *USGBC website, http://www.stpaul.gov/index.aspx?nid=2640, which states that LEED certified homes are predicted to reduce energy usage 30-60% compared to International Conservation Code standards, and that lowering operating costs for homebuyers or tenants is a major marketing benefit.*

The Ford site has the potential to be a highly sustainable legacy site, but it will take careful planning and hard work to get there. It will require inspired commitment and leadership from elected officials, key stakeholders, the community, and the land owner/developer.

District Sustainability Standards

The Most Livable City in America

Eleven Components

The Ford Site Sustainable Redevelopment Team worked in and out of meetings over several months to identify and describe key categories of sustainable redevelopment for the Ford site. Each category is detailed in the following pages, including goals, site performance standards, strategies for design, and links to resources.

These pages lay out an aggressive sustainable redevelopment agenda for the Ford site and mechanisms to move the agenda forward in cooperation with policy makers, developers and the community.

1.0 Building Energy
2.0 Transportation & Public Realm Network
3.0 Materials
4.0 Water & Wastewater
5.0 Solid Waste
6.0 Stormwater & Groundwater
7.0 Soil
8.0 Vegetation & Habitat
9.0 Recreation & Public Space
10.0 Night Sky Radiation
11.0 Urban Heat Island

COMPONENT

1.0 Building Energy

"Business as usual will lead to a different planet…We can't afford to wait another 10 years."

James Hansen, Director of NASA's Goddard Institute for Space and a world expert on global warming, December 2005

Four of the top five global warming reductions are conservation measures for buildings. Achieving these gains can come at no cost.

Buildings are the single biggest user of energy and emitter of carbon dioxide (CO_2). Buildings today represent 40% of the world's energy demand—33% of that from commercial buildings and 67% from residential buildings—and are responsible for 30-40% of carbon dioxide emissions worldwide. Worldwide energy consumption for buildings is expected to grow 45% from 2002 to 2025 (*World Business Council for Sustainable Development (WBCSD), 2009).* The good news is that there is a larger margin of conservation that buildings can implement to reduce both energy and carbon.

> "Existing technologies combined with common sense design can increase energy efficiency by 35% and reduce heating costs by 80% for the average building in industrialized markets" - *United Technologies Corporattion Chairman and CEO George David, 2007*

Achieving these gains can come at no cost. According to a report on energy efficiency by the WBCSD, a 30% reduction in building energy is achievable with little or no cost if completed in an integrated design approach.

The McKinsey Group is a management consulting firm advising leading companies on issues of strategy, organization, technology, and operations. They conducted a study on the most cost effective ways to reduce CO_2e the world over. The results were in this order:

1) Building insulation improvements
2) Fuel efficient commercial vehicles
3) Efficient lighting systems
4) Efficient air conditioning systems
5) Efficient hot water systems

Four of the top five global warming reductions are conservation measures for buildings. The report also states that conservation measures are known technologies that can be implemented immediately and at zero cost to the U.S. economy.

Sustainability Goals

- To maximize the use of renewable energy for buildings and infrastructure.
- To reduce operating energy use in all buildings and infrastructure.
- To maximize energy self-sufficiency.

District Sustainability Standards

Minimum Performance Thresholds

1.1 Meet energy use and greenhouse gas (GHG) emission targets* specified in Minnesota 2030 program to be required for State buildings through Building, Benchmarks & Beyond (B3) Guidelines and consistent with Saint Paul's Green Building Policy:

- 60% reduction by 2010
- 70% reduction by 2015
- 80% reduction by 2020
- 90% reduction by 2025
- 100% reduction by 2030

Ultimate Condition

Zero net energy and zero greenhouse gas emissions*.

** Greenhouse gas (GHG) emissions can be calculated based on operating energy, as well as on many other contributing factors measured by the Minnesota Building Carbon Calculator, including water, wastewater, waste, embodied in materials, transportation, vegetation, and soil.Energy use can be measured per square foot, per person, per hour of operation, per product output relative to equivalent industrial process, or a combination of these.*

Strategies

1. Meet on-site energy needs with a fully integrated district energy system.
2. Use all feasible types of renewable energy on site.
3. Reduce fossil fuel energy consumption by utilizing low-energy building technologies such as daylighting, natural ventilation, and evaporative cooling.
4. Reduce building energy load by employing additional building insulation and energy efficient fixtures, appliances, and energy systems.
5. Purchase carbon free energy, as available.
6. Reduce public infrastructure energy use by using low-energy or self-powered technologies such as solar powered light emitting diodes (LED) lighting throughout site streetlights and within other site elements such as fountains, parks, and transit facilities.

Resources

"A WBCSD Report: Energy Efficiency in Buildings: Business Realities and Opportunities" from http://www.wbcsd.org/DocRoot/qUjY7w54vY1KncL32OVQ/EEB-Facts-and-trends.pdf

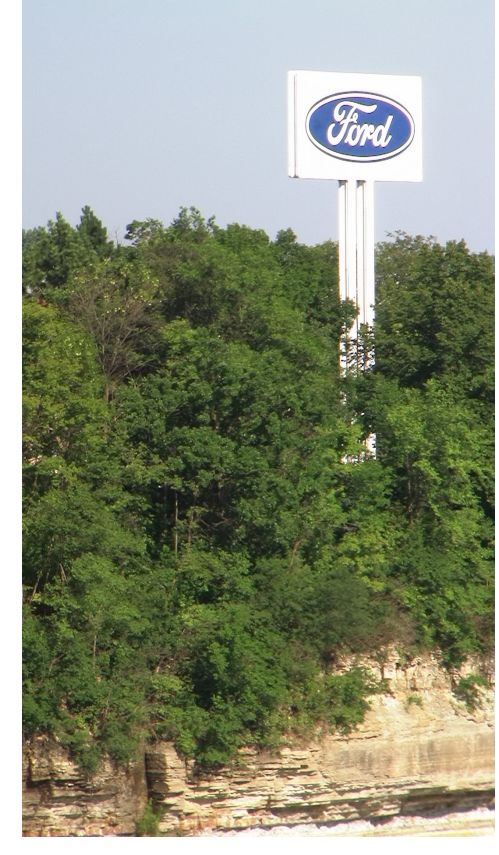
Crawley, D., Deru, M., Pless, S., and P. Torcellini. "Zero energy Building: A Critical Look at the Definition," NREL/CP-550-39833 (June 2006) from http://www.nrel.gov/docs/fy06osti/39833.pdf

"Low Energy Building Design Guidelines by the Federal Energy Management Program" from http://www1.eere.energy.gov/femp/pdfs/25807.pdf

"How to Design and Build an Energy Efficient Building" from http://www.isover.com/Q-A/Green-facts-energy-efficiency/How-to-design-and-build-an-energy-efficient-building

"McKinsey Report: Reducing U.S. Greenhouse Gas Emissions: How much at what cost?" from http://www.mckinsey.com/clientservice/ccsi/greenhousegas.asp

Minnesota B3 Guidelines, Energy and Atomosphere sections from http://www.msbg.umn.edu/



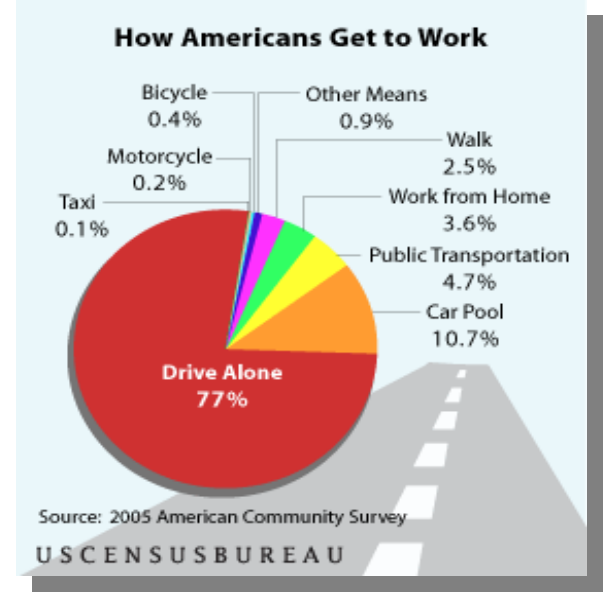
COMPONENT

2.0 Transportation & Public Realm Network

"If you live in a city, you don't need to own a car."

- William Clay Ford Jr., Chair, Ford Motor Company Ltd., October 2000

"The research shows that one of the best ways to reduce vehicle travel is to build places where people can accomplish more with less driving…Depending on several factors, from mix of land uses to pedestrian-friendly design, compact development reduces driving from 20 to 40 percent, and more in some instances…" - *Reid Ewing, Research Professor at the National Center for Smart Growth, University of Maryland*



Car and truck travel in cities consumes valuable urban land for roads, increases air pollution, reduces water quality through urban runoff, and creates safety conflicts with other modes of travel. The car has dominated development patterns for the past half-century, at the expense of other viable and healthier forms of travel and has subsidized the inefficient use of land and water. That tide is now turning, as scientists, urban designers, economists and policy-makers identify the multiple benefits of a more compact and multi-modal development pattern. Any new site development that occurs should be constructed to maximize transportation options such as walking, biking and transit.

"Although many air pollutants are invisible, they can seriously impact our health, the environment, and our quality of life. Air pollutants may cause respiratory diseases, cancer, and other health effects. Pollutants also may create odors and smog, diminish the protective ozone layer, and contribute to other environmental problems, such as acid rain and global climate change. …MPCA seeks to reduce direct man-made emissions of fine particles by 15 percent from 2002 levels by 2012…. This study found that gasoline and diesel combustion (mobile) sources contribute one-third to one-half of fine particle concentrations in highly populated urban areas…." – *Air Quality In Minnesota: Emerging*

trends – 2009, Report to the Legislature, Minnesota Pollution Control Agency.

A comparison of travel mode choice in other countries demonstrates that change is possible. Such a shift saves money, reduces air pollution, and improves personal health. In 2000, Europeans walked an average of 239 miles per person per year, while Americans walked 88 miles. Europeans biked an average of 116 miles per person per year and Americans biked 25 miles. - University of Tennesee Obesity Research Center study, Journal of Physical Activity and Health, November 2008.

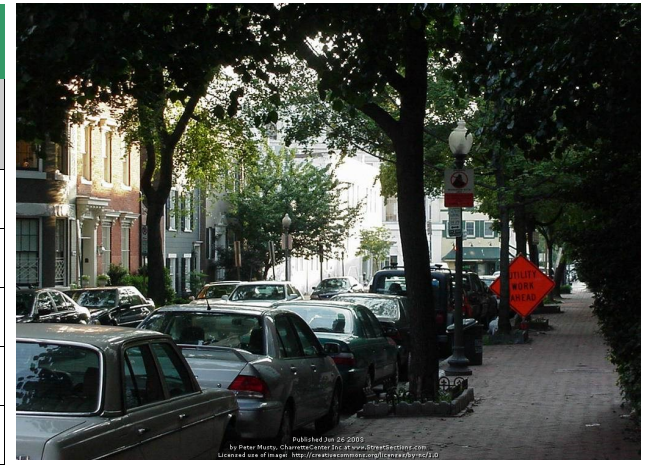
"Today's epidemic of overweight and obesity threatens the historic progress we have made in increasing American's quality and years of healthy life… Americans need to live and work in environments that help them practice healthy behaviors…Neighborhoods and communities should become actively involved in creating healthier environments. Communities should consider the geographic availability of their supermarkets, improving residents' access to outdoor recreational facilities, limiting advertisements of less healthy foods and beverages, building and enhancing infrastructures to support more walking and bicycling, and improving the safety of neighborhoods to facilitate outdoor physical activity." - *The Office of Surgeon General, United States Dept. of Health & Human Services Website, May 3, 2010*

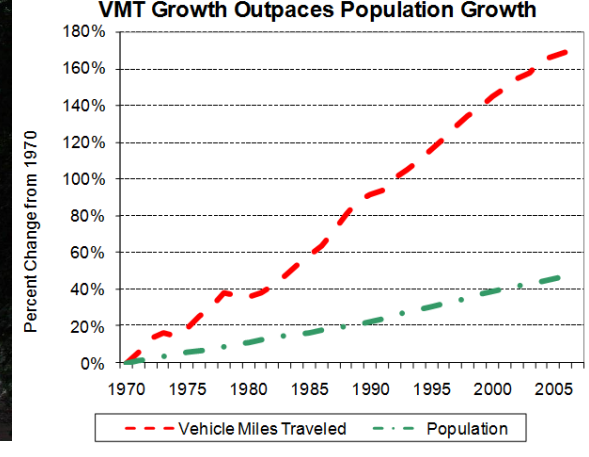
"The streets of our cities and towns are an important part of the livability of our communities. They ought to be for everyone, whether young or old, motorist or bicyclist, walker or wheelchair user, bus rider or shopkeeper. But too many of our streets are designed only for speeding cars, or worse, creeping traffic jams." *- From National Complete Streets Coalition website.*

Popularity of Transportation Modes

Trips by...	USA	Canada	Nether-lands
Car	89%	76%	45%
Public Transit	2%	10%	7%
Walking	6%	10%	18%
Bicycle	< 1%	2%	28%
Other	3%	2%	2%

Taken from a lecture by Dr. John Pucher, 1999.





District Sustainability Standards

"Today's epidemic of overweight and obesity threatens the historic progress we have made in increasing American's quality and years of healthy life… Americans need to live and work in environments that help them practice healthy behaviors."

Office of the Surgeon General, United States Department of Health & Human Services website, May 3, 2010

Sustainability Goals

- To create a transportation infrastructure that balances modal choice between walking, biking, and vehicular movement.
- To reduce average vehicle miles driven by persons living, working and visiting the site.
- To increase average walking and biking miles per year for persons living or working on the site.
- To reduce energy use and Green House Gas (GHG) emissions) related to high vehicle miles driven (VMD).
- To reduce adverse human health affects (such as asthma) related to air pollution.
- To maximize the diverse human benefits (such as childhood obesity reduction and lower family transportation costs) of safe and pleasurable pedestrian and multi-modal access to and from (on-site & off-site) transit stops, daily services, institutions, parks and public spaces.

Minimum Performance Thresholds

2.1 Provide mix of office, industrial, residential, and commercial uses on site that complement the existing mix of uses and services in the area.

2.2 Minimum residential density (du/acre) greater than 20 du/acre (*Density to be calculated using LEED-ND computational method outlined NPD Credit 2.*).

2.3 Minimum Non-Residential floor area ratio (FAR) greater than 1.50 (*Non-Res. FAR to be calculated using LEED-ND computational method outlined NPD Credit 2.*).

2.4 Internal street connectivity (intersections/ square mile according to LEED-ND definition) equal to or greater than the highest connectivity found in adjacent neighborhoods, computed for adjoining area of same size and shape as site.

2.5 All streets and intersections to utilize design methodologies consistent with 2010 ITE Manual: Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, An ITE Recommended Practice, and with "Complete Streets" design principles.

2.6 Zero dead ends and zero cul-de-sacs except to serve the rear of buildings.

2.7 95% of streets lined on both sides with sidewalks minimum 54" wide. (Per ADA requirements)

2.8 Provide designated bike lanes on streets at least every ½ mile.

2.9 50% of all residential and non-residential building entries within ¼ mile of vehicle sharing site or transit services.

Ultimate Condition

Decrease average vehicle miles driven to 4,000 or less per driving resident per year, a 50% reduction in carbon per mile traveled.

Strategies

1. Design all thoroughfares to encourage multi-modal travel with dedicated space for bicycle and pedestrian movement – consistent with Complete Streets principles.
2. Use site-wide design techniques meeting all prerequisites and the majority of applicable credits in LEED-ND section II: Neighborhood Pattern & Design (NPD).
3. Provide transit hub on site.
4. Provide heated sidewalks and shelters at transit stops to prevent snow build up and provide protection from bad weather.
5. Provide publicly available electric vehicle charging stations in parking facilities at commercial and employment nodes on site.
6. Provide publicly available car share vehicles on site.

Resources

- "Air Quality In Minnesota: Emerging trends – 2009 Report to the Legislature," Minnesota Pollution Control Agency. Retrieved from http://www.pca.state.mn.us/publications/lraq-1sy09.pdf
- Bassett, Jr., D., Pucher, J., Buehler, R., Thompson, D., and S. Crouter. "Walking, Cycling and Obesity Rates in Europe, North America and Australia," *Journal of Physical Activity and Health,* 2008, 5, 795-814 (2008) Human Kinetics, Inc. Retrieved from http://policy.rutgers.edu/faculty/pucher/JPAH08.pdf
- Car sharing website and networks available at http://www.carsharing.net/where.html
- *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, An ITE Recommended Practice* (2010) from http://www.ite.org/emodules/scriptcontent/Orders/ProductDetail.cfm?pc=RP-036A-E
- Ewing, R.., Bartholomew, K., Winkelman, S., Walters, J., and D. Chen. *Growing Cooler: The Evidence on Urban Development and Climate Change*, Urban Land Institute. Excerpt at http://www.smartgrowthamerica.org/gcindex.html
- Frank, L., Andersen, M., and T. Schmid. "Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars," American Journal of Preventive Medicine (2004). Retrieved from http://199.175.219.1/parks/activecommunity/pdf/JAN2007FRANKfinal-embargoed3.pdf
- Island, R., Harvey, J., and C. Hasang. "Transportation innovation-Freiburg Germany," Cornell University (December 2008) from http://courses.cit.cornell.edu/crp384/2008reports/11Freiburg_Germany.pdf
- *Minnesota B3 Guidelines*, Site and Water sections from http://www.msbg.umn.edu/
- National Complete Streets Coalition information available at http://www.completestreets.org/
- "Transportation Almanac: Statistics about Cars, Energy, Pollution, Bikes, and more," from http://www.bicycleuniverse.info
- "30 Simple Energy Things You Can Do to Save the Earth," Los Angeles: South California Edison, p. 11 (1990).
- Active Living Resource, provides articles and information on the relationships between active living, urban design, and health. Available at http://www.activelivingresearch.org/resourcesearch/journalspecialissues/jpah
- Bassett, Pucher, Buehler, Thompson and Crouter, "Walking, Cycling, and Obesity Rates in Europe, North America, and Australia" Journal of Physical Activity and Health, 2008, 5, 795-814 (2008) Human Kinetics, Inc. Availble at http://policy.rutgers.edu/faculty/pucher/JPAH08.pdf

COMPONENT

3.0 Materials

"By 2030, it is estimated that the earth's population will be 10 billion. Significant quantities of resources will be required to provide buildings for this population. Questions concerning the capability of the earth to support such a large population have arisen. Moreover, the extraction and utilization of these resources can have negative impacts on the environment."

Ho Lay Kien and George Ofori, "Minimising environmental impacts of building materials in Singapore: role of architects", International Journal of Environmental Technology and Management, 2002.

To conserve scarce energy and raw materials, it is crucial that the life cycle impact of materials is considered in redeveloping sites and that more effort is made to use recycled products or ones produced using less energy and raw materials.

Materials used for buildings, landscapes, and infrastructure have environmental impacts during the resource extraction, transportation, construction, manufacturing, and disposal phases. Therefore, a life cycle environmental assessment must include all of these phases for a complete picture of the environmental impact of materials. Although many people focus on the energy consumption and waste from a building in evaluating its environmental impact, materials that go into building construction represent between 8-15% of the total energy that a building will consume over its useful life.

Waste during the product development process is substantial as well. For each pound of usable copper refined, three tons of waste is created. Often times this ratio can be as high as 70 to one. Wasted materials mean that raw materials go unused, which is a problem in a world where the total amounts of accessible raw building materials are declining.

Sustainability Goal

- To reduce embodied energy use, GHG emissions and other environmental impacts associated with building, infrastructure, and landscape materials.

District Sustainability Standards

Minimum Performance Threshold

3.1 Life-cycle performance of all new buildings at least 10% better than average using Athena EcoCalculator in six of the eight output areas, or comply with State of Minnesota B3 Guidelines, Materials and Waste, section M.1 - Life Cycle Assessment of Building Assemblies.

3.2 Comply with State of Minnesota B3 Guidelines, Materials and Waste, section M.2 - Environmentally Preferable Materials.

3.3 At least 30 percent of the total value of materials used in site infrastructure are composed of pre- and post-consumer content.

Ultimate Condition

Life-cycle performance of all new buildings at least 30% better than average using Athena EcoCalculator in seven of the eight output areas.

Exceed required performance criteria in State of Minnesota B3 Guidelines, Materials and Waste, section M.2 - Environmentally Preferable Materials, by 10 percent.

At least 50 percent of the total value of materials used in site infrastructure are composed of pre- and post-consumer content.

Strategies

1. Reuse existing buildings or components of existing buildings.
2. Recycle existing building elements.
3. Allow demolished building materials to enter the recycling stream.
4. Use recycled and locally sourced materials.
5. Use materials for buildings and site infrastructure that have low environmental impact.
6. Support building materials exchanges.
7. Lay out blocks and buildings modularly to facilitate long term expansion, reuse, or repurposing of buildings and site infrastructure.
8. Seek and use locally and regionally sourced materials as available.

ATHENA® EcoCalculator

Life cycle analysis of materials which measures the following eight outputs:

Primary energy use
Global warming potential
Ozone depletion
Acidification
Eutrophication
Photochemical smog
Particulate matter
Weighted raw resource use

www.athenasmi.org/tools/ecoCalculator/

Resources

- American Society of Landscape Architects, Sustainable Sites Initiative: Guidelines and Performance Benchmarks - Materials Selection, Credit 5.5. from http://www.sustainablesites.org/report
- BEES® (Building for Environmental and Economic Sustainability) version 4.0, a software program developed by the NIST (National Institute of Standards and Technology) Building and Fire Research Laboratory. Available from http://www.nist.gov/el/economics/BEESSoftware.cfm
- Friedman, A., and V. Cammalleri, "The environmental impact of building materials in the North American building industry," Building Research & Information, Volume 23, Issue 3 May 1995 , pages 162 - 166. Retrieved from http://www.informaworld.com/smpp/content~db=all~content=a778286230~frm=titlelink
- Kien, H. and G. Ofori, "Minimising environmental impacts of building materials in Singapore: role of architects," International Journal of Environmental Technology and Management 2002 - Vol. 2, No.1/2/3 pp. 244-266.
- Minnesota B3 Guidelines, Materials and Waste sections from http://www.msbg.umn.edu/
- USGBC's LEED-ND Green Infrastructure and Building, Credit 15 from http://www.usgbc.org/ShowFile.aspx?DocumentID=8880

COMPONENT

4.0 Water & Wastewater

"Our nation's water/ wastewater infrastructure is literally crumbling beneath our city streets...The hidden problem for America is 70 to 100 years of water and sewer lines that don't have the capacity to respond to today's population growth and vastly increased water use and reuse."

James Oberstar, U.S. Congressman, Minnesota, 2004

It remains unclear what level of water use is in the Twin Cities area is sustainable, but maximizing efficiency and conservation in potable water will play key roles in a sustainable scenario and should be a priority in new site development.

Minnesota is known as the "Land of 10,000 Lakes" and thought to have an abundance of water. However, in 2007, the water well pumps went dry in the City of Chanhassen in the Twin Cities region. Like many other municipalities in the metro area, Chanhassen relies heavily on aquifers. Alarmingly, due to pollution caused by stormwater runoff and increasing ground-water withdrawals, water levels in the principal aquifers beneath the Twin Cities have been declining since the onset of development in the 1880's *(Horn, MA. Ground-Water-Use Trends in the Twin Cities Metropolitan Area, Minnesota, 1880-1980. 1983. St Paul MN, U.S. Geological Survey).* Ground-water withdrawals from the highly-used Prairie du Chien-Jordan, Franconia-Ironton-Galesville, and Mt. Simon -Hinckley aquifers are expected to increase considerably by 2010. The result will be that more Minnesota cities will experience water shortages like Chanhassen.

It is not realistic to "build our way" out of the water supply problem. The costs of new infrastructure for water systems to replace those that are too polluted or depleted are prohibitive. Additionally, the operational costs are expensive in an energy intensive waste treatment and conveyance system.

The Twin Cities Metropolitan Council waste water treatment plants treat 255 million gallons of waste water daily – over 93 billion gallons a year. Over ten years, 1.4 billion dollars will be budgeted to upgrade and maintain over 600 miles of interceptor pipe and eight treatment plants. The infrastructure uses about 230,000 megawatt hours of energy per year costing about 1.4 million dollars and producing about 236,000 tons of CO_2e.*

We can re-conceptualize the idea of "waste water" and find ways to reuse gray water and black water in order to increase efficiency and conservation. Gray water comprises 50-80% of residential waste water, with the remainder composed of blackwater from the toilet.

Gray water, water from tub, shower, laundry and sinks, is easily "down cycled" to flush toilets or irrigate lawns and landscaping. It can also be economically recycled to drinking water standards. By recycling or down cycling, energy and carbon emissions from the water and waste water treatment processes can be reduced.

Black water can be composted either aerobically or anaerobically on site. Aerobic treatment of black water will produce a soil amendment that can be used on all non-edible plants. Anaerobic digestion of black water will produce methane gas and soil which can be used to supplement the heating of buildings and the fertility of soil on site. Many anaerobic digestion technologies are commercially available and have been demonstrated for use with agricultural wastes and for treating municipal and industrial wastewater.

Sustainability Goals

- To reduce potable water consumption in all buildings and landscapes.
- To reduce wastewater leaving the site to treatment plants from all buildings and landscapes by increasing onsite wastewater reuse.

District Sustainability Standards

Minimum Performance Thresholds

4.1 Predicted potable water use must be 30% below EPA Policy Act of 1992 (consistent with Saint Paul Green Building Policy).

4.2 Predicted water use for landscaping must be at least 50% less than a traditionally irrigated site (consistent with Saint Paul Green Building Policy).

4.3 Fifty percent (50%) less black and/or gray water leaving the site than an average or typical development, during design phase and long-term operations.

Ultimate Condition

No more than five percent (5%) of the total daily water requirement/person imported to site.

Zero gray water leaving the site, and ten percent (10%) or less black water leaving the site during design phase and long-term operations.

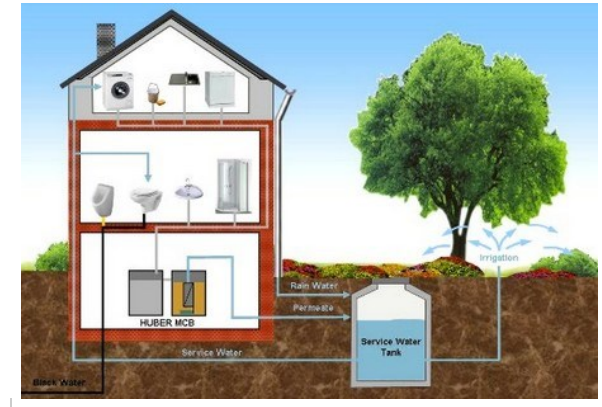
* **Carbon Dioxide Equivalence (CO_2e)** is a quantity that describes, for a given Greenhouse Gas, the amount of CO_2 that would have the same global warming potential, when measured over a specified timescale (generally, 100 years).

Strategies

1. Install gray water recycling systems.
2. Install rainwater cisterns and rain barrels.
3. Install black water composting and wetland systems.
4. Install low flow water fixtures, toilets and waterless urinals.

Resources

- EPA WaterSense from http://www.epa.gov/watersense/
- LA Water Solutions from http://www.piersystem.com
- Metropolitan Council's Water Toolbox from http://www.metrocouncil.org/environment/WaterSupply/conservationtoolbox.htm
- Minnesota B3 Guidelines, Site and Water sections from http://www.msbg.umn.edu/
- Saint Paul Green Building Policy — found at http://www.stpaul.gov/index.aspx?NID=3671
- WaterWise: Install water saving tools and strategies from http://www.livingthing.net.au/WYKD_h1b.htm
- 10 water-saving strategies will save you money from http://www.gjsentinel.com/news/content/news/stories/2009/06/12/061309_HG_Drip.html



"A century ago, the average American used only about 10 gallons of water a day to drink, cook, clean, and bathe. Today, Americans use 100 gallons a day per person on average, causing stresses on our sources of drinking water."

Environmental Protection Agency webpage: Water & Wastewater Pricing: http://www.epa.gov/waterinfrastructure/pricing/ - page visited May 8, 2010

COMPONENT

5.0 Solid Waste

Throwing material away only transfers the problem to another location and pollutes the ecosystem - the real solution is to reduce solid waste itself.

"Today, cities generate nearly three times as much solid waste as they did in 1960."

Solid Waste Infrastructure - Immigration and Infrastructure", by Edwin S. Rubenstein, The Social Contract Journal, Volume 19, Number 2 Winter 2008-2009
http://www.thesocialcontract.com/pdf/nineteen-two/tsc_19_2_solid_waste.pdf

In the United States, the average life of a purchased good is 18 months from the time of purchase to the time it is thrown away. About 80 percent of products in the United States are used once and thrown away. Today, cities generate nearly three times as much solid waste as they did in 1960. The actual figure is 70-fold larger, since production waste outweighs household or "municipal solid waste" by 70 to one. This contemporary culture of waste is reflected in construction practices as well. Waste related to building construction has been estimated at 40 percent of the total waste arriving in landfills.

In Minnesota, recycling rates have stayed at around 30 percent of all solid waste since the year 2000. Another small percentage of the waste is incinerated, with the remaining waste discarded into landfills, about 55 percent on average nationally according to the Environmental Protection Agency (EPA). Landfills are not a good option for waste. For example, "… 82 percent of surveyed landfill cells had leaks, while 41 percent had a leak area of more than one square foot" (Leak Protection Services, Inc., March 15, 2000), meaning the waste that goes into a landfill does not remain there and instead contaminates local soil and water systems.

At a neighborhood level, waste reduction helps reduce traffic, noise, and pollution associated with waste collection and hauling, as well as reducing wear and tear on streets.

The following are three primary techniques for more sustainable disposal of 100% of the typical municipal solid waste stream:

1) **Compost** (65%): All of the following can be composted on site, amounting to 65% of the waste stream: 34% Paper, 13% Yard Waste, 12.4% Organic Food Waste, and 5.5% Wood.
2) **Recycle** (25%): All of the following can be recycled, amounting to 25% of the waste stream: 11.7% Plastics, 7.6% Metals, 5.3% Glass
3) **Reuse** (10%): Less than 10% remains and must be reused in a suitable manner. Use of websites such as Freecycle can assist in moving larger items from a place where they are no longer needed to a place where they are wanted.

Sustainability Goals

- To reduce solid waste from construction in all buildings and landscapes.
- To reduce solid waste from operation of all buildings and landscapes.

District Sustainability Standards

Minimum Performance Thresholds

5.1 Seventy five percent (75%) of all construction waste must be recycled (consistent with Saint Paul Green Building Policy).

5.2 Fifty percent (50%) less household, commercial and industrial solid waste leaving the site than an average or typical development.

Ultimate Condition

Zero construction, residential, commercial and industry solid waste leaving the site.

Strategies

1. Reduce the purchase of new products, reuse as much as you can and then recycle as many items as possible.
2. Utilize anerobic digestion systems or Waste-to-Energy (WtE) or Energy-from-Waste (EfW) facilities and technologies in the local area and / or on-site.
3. Support weekly curbside recycling for residential and commercial uses.
4. Utilize neighborhood composting sites for disposal and reuse of compost.
5. Support local charity, neighborhood and commercial clean-up and reuse events. Utilize internet resources to facilitate item reuse (one person's trash is another person's treasure).
6. Identify waste reuse opportunities on site or in the area.

Resources

> for Developers

- City of Saint Paul Sustainable Building Policy http://www.ci.stpaul.mn.us/index.aspx?NID=3269
- Minnesota B3 Guidelines, Site and Water sections from http://www.msbg.umn.edu/
- The Reuse Center http://www.TheReuseCenter.com/
- Unitd States Green Building Council Minnesota http://www.usgbcmn.org
- Waste-to-Energy (WtE) and Energy-from-Waste (EfW) technologies, ... http://www.mnresourcerecovery.com definitions and examples from http://en.wikipedia.org/wiki/Waste-to-energy

> for Workers & Residents

- City of Saint Paul http://stpaul.gov/recycle
- Eureka Recycling http://www.EurekaRecycling.org
- Ramsey County A to Z Disposal Guide http://www.co.ramsey.mn.us/ph/rt/a_to_z_disposal_guide
- Recycle batteries: http://biggreenbox.com
- Reduce waste in your mailbox by getting off junk-mail lists: http://stpaul.gov/recycle
- Kids go green information at http://www.epa.gov/kids/ , http://sierraclub.typepad.com/mrgreen/
- Recycle cell phones and computers: http://www.computertakeback.com, http://www.flipswap.com
- Reuse by borrowing, swapping, and sometimes purchasing (akin to a local garage sale, but in cyberspace): http://www.twincitiesfreemarket.com, http://www.thegivingeffect.com
- The Story of Stuff Project and short film by Annie Leonard, from http://www.storyofstuff.com/
- Recycling stations in your local area – locations and what they do and don't recycle from http://earth911.com/, http://www.RethinkRecycling.com
- Composting http://www.makedirtnotwaste.org , http://www.urbancompost.net

COMPONENT

6.0 Stormwater & Groundwater

"We came from the water; our bodies are largely water; and water plays a fundamental role in our psychology. We need constant access to water, all around us; and we cannot have it without reverence for water in all its forms.

But everywhere in cities water is out of reach. Even in the temperate climates that are water rich, the natural sources of water are dried up, hidden, covered, lost. Rainwater runs underground in sewer; water reservoirs are covered and fenced off...

...But it is possible to imagine a town where there are many hundreds of places near every home and workplace… "

(cont. page 29)

Development drastically alters the hydrological cycle, as the increase in hard, impervious surfaces associated with development decreases infiltration and evaporation and increases stormwater runoff.

There are negative impacts on downstream water bodies associated with changes in the hydrologic cycle if runoff is piped directly into receiving water bodies. These include:

- increased bounce in water levels, increasing lakeshore/stream bank erosion and negative impacts on stream morphology and biota
- increased flooding
- decreased ground water recharge
- runoff which is not filtered through soil and is not filtered and cooled before reaching receiving water bodies, resulting in higher water pollution and temperatures

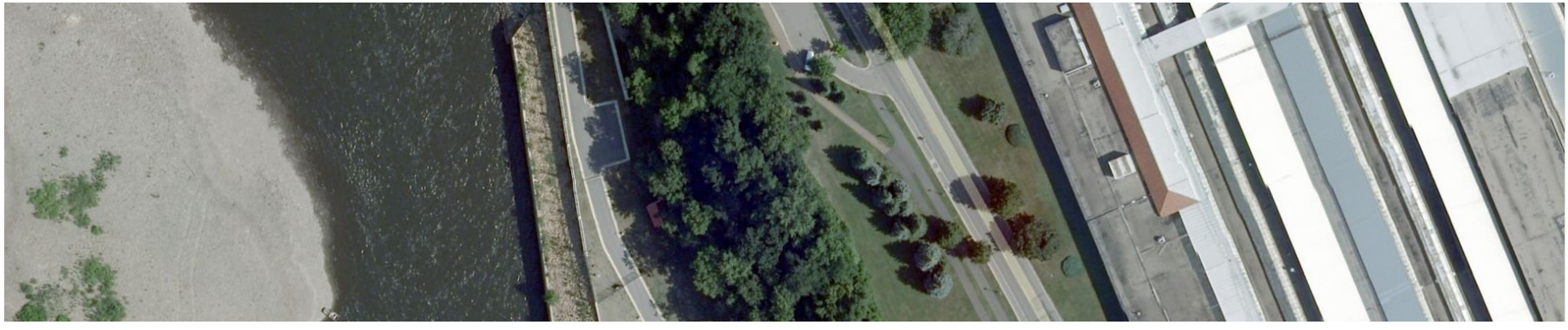
Designing the landscape using Low Impact Development (LID) techniques for storm water management minimizes the negative impacts of development on local water bodies and provides a paradigm shift from treating stormwater runoff as a waste product to treating it as a valuable resource.

The Ford site and nearby railroad parcel currently are covered by 85% impervious surfaces on 135 acres of land.

As in other areas of Saint Paul, most of the runoff from the site discharges into the Mississippi River untreated. The opportunity to redevelop the Ford site using LID techniques offers potential to make a significant positive impact on the river.

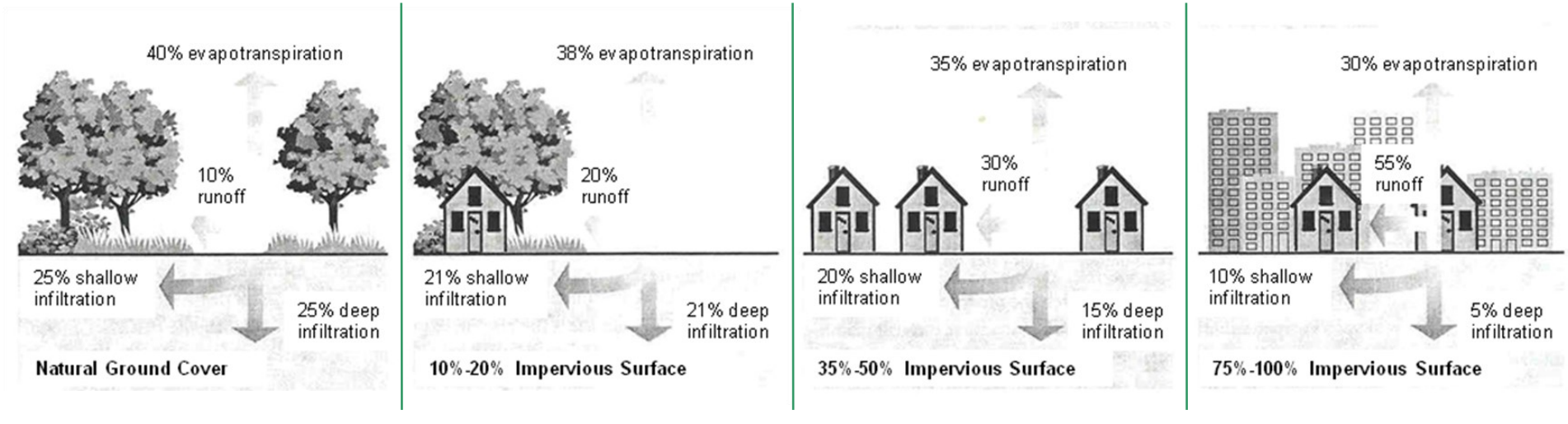
Sustainability Goals

- To minimize surface and ground water pollution.
- To minimize negative impacts of development on the hydrological cycle by treating stormwater close to where it falls and recharging groundwater through infiltration as local soils and subsurface conditions allow.
- To not exceed natural erosion and sedimentation levels in streams and lakes.
- To protect plant, invertebrate, and animal life in lakes and streams.
- To utilize stormwater runoff as a resource rather than as a waste product.
- To pre-treat all water flowing to Hidden Falls and maintain a more constant flow volume.



Aerial Image of the Miississippi River, South Mississippi River Blvd., and the Ford Plant

Source: Google Maps



Relationship Between Impervious Cover and Surface Runoff

Federal Interagency Stream Restoration Work Group, FISRWG 1998. Stream Corridor Restoration: Principles, Processes and Practices.

District Sustainability Standards

"… where there is water.

...Natural streams in their original streambeds, together with their surrounding vegetation can be preserved and maintained...

...Rainwater can be allowed to assemble from rooftops into small pools and to run through channels along garden paths and public pedestrian paths, where it can be seen and enjoyed...

...Fountains can be built in public places. And in those cities where streams have been buried, it may be possible to unravel them again."

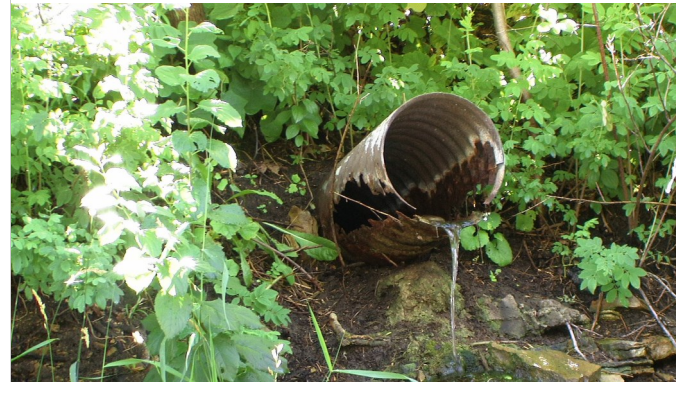
Alexander, C. Ishikawa, S. and M. Silverstein. 1977. A Pattern Language: Towns, Buildings, Construction. Oxford University Press, NY NY

For detailed information and recommendations regarding stormwater planning for the Saint Paul Ford site, see a companion report funded by the Minnesota Pollution Control Agency and prepared by Barr Engineering:

Sustainable Stormwater Feasibility Report
for the Ford Plant Site

Prepared for City of Saint Paul
February 24, 2010
http://www.stpaul.gov/DocumentView.aspx?DID=12751

BARR



Minimum Performance Standards

6.1 Comply with current local regulations for stormwater runoff volume and rate control (City of St. Paul, Minnesota Pollution Control Agency (MPCA), Capitol Region Watershed District (CRWD), State of Minnesota B3 guidelines).

6.2 Reduce runoff volume by at least 90% on an annual basis by infiltration (50%) and evaporation or re-use (40%) or provide a corresponding water quality benefit.

6.3 Reduce pollutants for which the water is impaired to 10% less than levels identified in Total Maximum Daily Load (TDML) study for that portion of the Mississippi River.

6.4 Maintain minimum cover (e.g. >3') above bedrock and follow Minnesota Pollution Control Agency (MPCA) Guidelines on infiltrating.

6.5 Produce and implement a Stormwater Pollution Protection Plan per MPCA guidelines for use pre, during and post construction.

Ultimate Condition

Zero discharge of untreated stormwater from site.

Re-direct low flows on adjacent properties away from untreated storm sewers and onto the Ford site for treatment in the site's comprehensive stormwater management system.

Strategies

1. Divide site into small catchment areas (≤ 1 acre).
2. Minimize impervious surface area for buildings and pavement using green roofs, pervious pavement, integrated tree and stormwater systems, and the like.
3. Capture, infiltrate, re-use, evaporate and evapotranspire rain that falls on site using:
    - directed runoff to rain gardens, bio-retention, filtration, and infiltration devices
    - trees with adequate volumes of uncompacted soils (extend soil volume under paved areas except city street drive lanes with appropriate substructures).
    - green roofs and green walls
    - pervious pavement
    - cisterns
    - treatment wetlands
    - devices to hold and clean sediment of first flush rain

Resources

- Best Management Practices, Environmental Protection Agency from http://water.epa.gov/scitech/wastetech/guide/stormwater/index.cfm

- Best management practices for stormwater management ,authored by the EPA (Summarized in Appendix S-2 Storm Water Quality Table), Minnesota Pollution Control Agency, Metropolitan Council, or Local Government Unit, available at http://www.msbg.umn.edu/s_2.html—(Summarized in Appendix S-2 Storm Water Quality Table found at http://www.msbg.umn.edu/downloads_v2_1/3SiteWater_App-S-2_V2-1.pdf)

- Board of Water Quality and Soil Resources (BWSR) information and resources available at http://www.bwsr.state.mn.us/

- Capitol Region Watershed District: standards available at www.capitolregionwd.org

- "City Charter and Code": City of St Paul Code of Ordinances: (Sections 52: Storm Water Pollution Prevention Plan (SWPPP) requirements, and 66: of zoning and land use regulations, 63: maximum peak discharge for parking structures, and 68) available at http://www.stpaul.gov

- International Stormwater BMP Database from http://www.bmpdatabase.org/

- Hanks, D. and A. Lewandowski, "Protecting Urban Soil Quality: Examples for Landscape Codes and Specifications," USDA-NRCS (12-20-2003) from http://soils.usda.gov/sqi/management/files/protect_urban_sq.pdf

- "Low Impact Development Design Strategies: An Integrated Design Approach," Prince George's County, Maryland. Department of Environmental Resources Programs and Planning Division (1999) from http://www.epa.gov/owow/NPS/lidnatl.pdf

- Minnesota B3 Guidelines, Site and Water sections from http://www.msbg.umn.edu/

- MPCA Standards performance thresholds, Minnesota Pollution Control Agency from http://www.pca.state.mn.us/index.php/water/water-monitoring-and-reporting/water-quality-and-pollutants/water-quality-standards.html

- "Protecting Water Quality in Urban Areas," Minnesota Pollution Control Agency (2000) from http://www.pca.state.mn.us/index.php/view-document.html?gid=7153

- Shaw, D. and R. Schmidt, *Plants for Stormwater Design: Species Selection for the Upper Midwest*_ Minnesota Pollution Control Agency (2003). Information available at http://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/stormwater-management/plants-for-stormwater-design.html?menuid=&missing=0&redirect=1

- "Sustainable Stormwater Feasibility Report for the Ford Plant Site," Barr Engineering (2009) from http://www.stpaul.gov/DocumentView.aspx?DID=12751

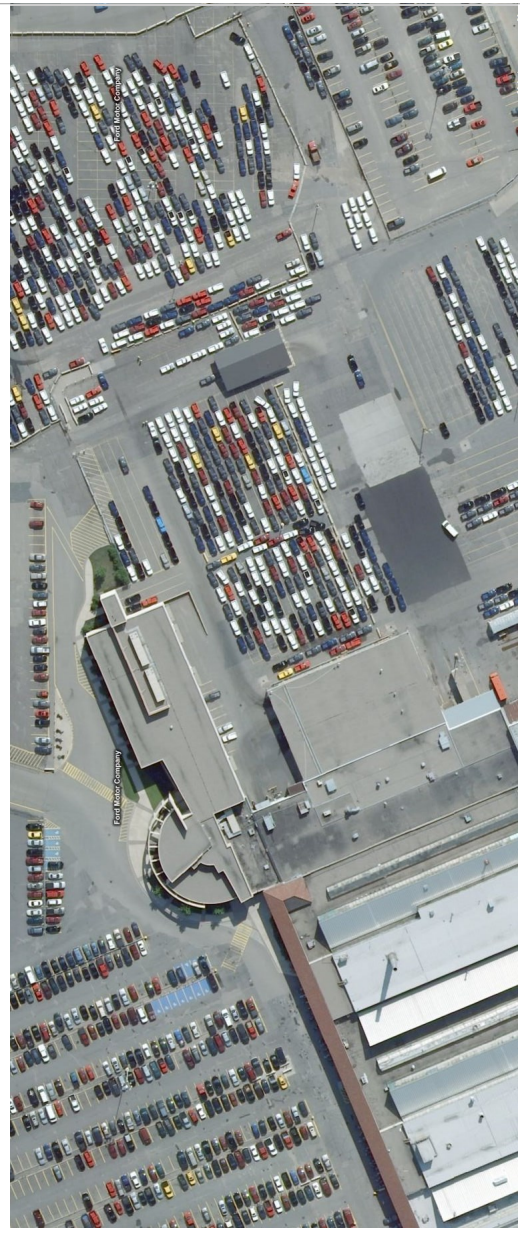
- Saint Paul Comprehensive Plan 2020 from http://www.stpaul.gov/index.aspx?NID=3427

- "Urban Small Sites Best Management Practices," Metropolitan Council, from http://www.metrocouncil.org/environment/Water/BMP/manual.htm

- Light Imprint Handbook , DPZ CHARLOTTE (2008). http://www.lightimprint.org/

COMPONENT

7.0 Soil



The Ford site has been in use as an industrial property for over 80 years.

As such, some level of soil restoration and enhancement will be advised to make the land usable for a range of activities, vegetation and stormwater treatment. Healthy soil is important.

Healthy Soil Is Crucial To Earth's Cycles.

Soil is crucial to interactions between the earth's crust and the atmosphere, where recycling of energy, water, gases, and nutrient elements occur. Without proper soil management, these activities may be compromised.

Healthy Soil Is Crucial To Plant Growth Which In Turn Supports Animal Life.

Healthy soil supplies support, water, nutrients and oxygen to plants and plant roots. The three phase matrix of soil – solid particles, air and water - need to be protected for soil to be able to support and sustain plant growth. Adequate plant growth in turn, is crucial to support animal life.

Soil Protection Is Crucial To Clean Water.

Unnaturally high erosion of lakeshores, streambanks, and surrounding watersheds contaminates streams and lakes. Sedimentation by eroded soil in turn disrupts fish and aquatic life in these water bodies. Compacted soil inhibits rain infiltration and filtration, increasing erosion.

Threats to healthy soil are accelerating, including erosion, loss of organic matter, compaction, salinization, landslides, contamination, and sealing. These negatively impact human health, natural ecosystems and climate change, as well as the economy.

Soil Management Guidelines

Source: **B3 State of Minnesota Sustainable Building Guidelines**

Organic matter >1.5% by dry weight

Bulk density < than 1.5 mg/m3

Aeration porosity (% large pore volume) >2%

Infiltration rate > 0.25 in/hr site wide, >1 in/hr in stormwater treatment areas

Soil pH 6-8.5

Cation exchange capacity > 5 meg/100g

Potassium > than 124 lbs/acre

Phosphorus > than 44 lbs/acre

Mycorrhizae — Minimum 2 species in soil that are naturally found in Minnesota

Soluble salt content < 600 ppm

Stormwater Pollution Prevention Plan (SWPPP) - create and implement

Hydric and mesic soils profile >10% of open space

Organic horizon > 4 inches throughout

Sustainability Goals

- To protect and restore soil structure, stability, and biological health to optimize plant health and species richness and optimize water infiltration and filtration.
- To reduce soil loss and minimize disturbance of existing quality soil.
- To maximize on-site reuse of existing soils.
- To address impacted soil conditions on site.

District Sustainability Standards

Minimum Performance Thresholds

7.1 Meet MPCA soil cleanup criteria with land use restrictions.

7.2 Meet B3 Guidelines for soil management. *(See facing page.)*

Ultimate Conditions

Meet thresholds 7.1 & 7.2, and in addition;

- **Meet Minnesota Pollution Control Agency (MPCA) soil cleanup criteria with no land use restrictions.**
- **Provide on-site composting location and provide composted material for on-site public and private gardening, landscaping and soil restoration.**
- **Hydric and mesic soils—profile > 20% of proposed open space.**
- **Organic horizon > 6 inches.**
- **Minimum 4 species of mycorrhizae in soil that are naturally found in Minnesota.**

Strategies

1. Create a Soil Management Plan for construction to protect soil profile of site for non-impacted soils.
2. Create and implement an Erosion and Sedimentation (ESC) plan for all construction activities that conforms with EPA Construction General Permit or local erosion and sedimentation control standards, whichever is more stringent, and enact a fine structure for all erosion control infractions.
3. Limit site disturbance (defined as piling, tilling, scraping, storing, and removal of any and all soil) to 5 ft. beyond tree drip-lines, the edges of site areas identified for protection, and to 25 ft. beyond pervious paving areas and stormwater management features that require additional staging areas in order to limit compaction in the constructed areas.
4. Protect existing trees as individuals or in groups by placing tree protection fence just beyond outer perimeter of existing tree dripline prior to any and all site activities.
5. Maintain and install/re-spread topsoil to a minimum 12" depth at no greater than 85% of ASTM (American Society for Testing and Materials) standards and 85% compaction rate.
6. Implement permanent erosion control after construction and monitor.
7. Where trees are surrounded by hard surfaces (patios, driveways, car parks, plazas, parking islands) use Silva Cells or comparable method to extend uncompacted soil volume under pavement with loads of up to AASHTO (American Association of State Highway and Transportation Officials) H20. Minimum uncompacted (< 85% Proctor ASTM) soil media mix per tree shall be:
   - Small trees (e.g. serviceberry): 400 cubic feet (c.f.)
   - Medium trees (e.g. ironwood): 800 c.f.
   - Large trees (e.g. bur oak): 1,200 c.f.
8. If above soil volumes cannot be met it is recommended that trees requiring smaller soil volumes be selected. Where applicable, utilize Silva Cells or comparable methods to allow tree roots to bridge under hard surfaces into open space.
9. Add compost to improve soil structure and composition.

Resources

- Minnesota B3 Guidelines, Site and Water sections from http://www.msbg.umn.edu/
- NRCS Soil surveys available for all Minnesota counties at http://soils.usda.gov/survey/online_surveys/minnesota/
- Craul, P. *Urban Soils: Applications and Practices*. New York: John Wiley & Sons (1999) - found at http://www.amazon.com/Urban-Soils-Applications-Phillip-Craul/dp/0471189030
- Mycorrhizal amendments potential provider: Mycorrhizal Applications, Inc. See http://www.mycorrhizae.com/
- Minnesota National Pollution Discharge Elimination System, information and resources available at http://www.pca.state.mn.us
- Specifications, details, and guidelines for Silva Cell design from http://www.deeproot.com/products/silva-cell/resources.html
- Urban, J., *Up by Roots: Healthy Soils and Trees in the Built Environment*. Int. Society of Arboriculture: Champaign IL. (2008) from http://www.thefreelibrary.com/Up+By+the+Roots--Healthy+Soils+and+Trees+in+the+Built+Environment-a0196151694

COMPONENT

8.0 Vegetation & Habitat

"When we heal the earth, we heal ourselves."

- David Orr

Maximizing ecosystem preservation and stability to the greatest extent feasible is critical to economic, social, and biological value and sustainability of the site.

The flora and fauna on the site will provide aesthetic and health benefits for all inhabitants and visitors to the site. At present, the Ford site is largely developed and lacks a strong vegetative and habitat layer. Reintroducing a strong system of plants in a strategic way will increase the site's value economically, environmentally, and aesthetically.

Re-vegetation of the site should focus on native plantings to increase the chances of plant success, reduce irrigation and related maintenance costs, and integrate the site with the surrounding area. The Mississippi River valley in the Twin Cities provides a wide variety of attractive trees, shrubs and perennial plants from which to choose. As appropriate, native plants may be complemented by street trees and private landscaping that is suitable to the area and low maintenance. Reintroduction of a strong vegetative system on the site, focused on native flora, will attract and support an array of native fauna.

Sustainability Goals

- To maximize biodiversity of the site and provide maximum possible contribution to local landscape ecology.
- To reduce destruction and removal of existing vegetation.
- To increase vegetation on site with new plantings.
- To provide wildlife habitat for diverse species.
- To maximize ecological services on site and for the surrounding area.

District Sustainability Standards

Minimum Performance Thresholds

8.1 Comply with applicable codes, regulations and standards, including B3 guidelines, St. Paul zoning and land use regulations, and City of St Paul River Corridor Overlay District.

8.2 Greater than fifty percent (50%) aerial tree cover over all impervious surfaces on site except roofs.

8.3 Greater than thirty percent (30%) of buildings include vegetated roofs.

8.4 Greater than twenty percent (20%) of site open space covered with vegetation.

8.5 Greater than seventy five percent (75%) native species in new landscaping, including keystone species; (at minimum) Burr Oak, Hickory/Walnut & Big Blue Stem.

8.6 Minimum plant species diversity greater than eighty percent (80%) species of native vascular flora – herbaceous perennials. No invasive species on the site. Use ten percent (10%) or less species of native Deciduous Trees and > 3 species of native Coniferous Trees, but not greater than ten percent (10%) of any one tree genus, in order to avoid catastrophic tree loss e.g. Dutch Elm Disease; Emerald Ash Borer.

8.7 Do not disturb habitat or natural resources determined significant by Minnesota DNR Natural Heritage Program or by local, state or federal government; maintain or install appropriate buffer width around significant habitats that comprise part of a development.

Ultimate Conditions

70% aerial tree cover over non-roof impervious surfaces, and 50% of buildings include vegetated roofs.

100% native tree, shrub, perennial and vine plantings compositions.

A species-rich, resilient, urban forest with ≥ 50% of tree population exceeding 20 inch Diameter Breast Height (DBH) and 20% exceeding 30 inch DBH.

Diverse ecosystem that supports at least the presence of key species as follows:

Amphibians (3 species); interior forest birds (10 species); interior grassland birds (3 species); bats (2 species); reptile (2 species).

Strategies

1. Inventory current vegetation and habitat resources with MN/DNR Natural Heritage staff.
2. Work with MN/DNR landscape ecologist to determine how best to complement existing landscape ecology by analyzing surrounding corridors, matrix and patches.
3. Identify and control invasive species to the maximum extent practicable.
4. Protect native species where present, restore native species where not present.
5. Use native plant communities as templates to inform species composition, frequency, and abundance for planting plans (e.g. per DNR field guides).
6. Implement long term maintenance for existing and restored native plant communities.
7. Blend plantings and plant communities with Mississippi River Critical Area.

Resources

- *Field Guides to Natural Plant Communities*, Minnesota Department of Natural Resources available at http://files.dnr.state.mn.us/publications/books/plantcommguide_orderform.pdf
- Minnesota B3 Guidelines, Site and Water sections from http://www.msbg.umn.edu/
- Minnesota Wetland Restoration Guide, Minnesota Board of Water and Soil Resources from http://www.bwsr.state.mn.us/publications/restoration_guide.html
- Native Plant Community and Rare Species County Maps, Minnesota County Biological Survey from http://www.dnr.state.mn.us/eco/mcbs/maps.html
- *Summary of State Seed Mixes*, Minnesota Board of Water and Soil Resources from http://www.bwsr.state.mn.us/native_vegetation/seedmix-summary.pdf
- Urban, J., *Up by Roots: Healthy Soils and Trees in the Built Environment*. International Society of Arboriculture: Champaign IL. (2008)
- Wovcha, D.S.; Delaney, B.C.; Nordquist, G.E., *Minnesota's St. Croix River Valley and the Anoka Sandplain: A Guide to Native Habitats.* University of Minnesota Press (1995) from http://www.upress.umn.edu/Books/W/wovcha_minn.html

COMPONENT

9.0 Public Space & Recreation

"The park system within a community should be considered a part of the overall infrastructure and investment in the community's natural capital."

-From "A new perspective on urban spaces: urban sprawl, new urbanism and the role of the parks and recreation field" Don DeGraff, Jill Lankford and Sam Lankford. National Parks and Recreation Association, August 2005.

Strong neighborhoods are built around a diverse public space system, where community members of all ages and incomes can exercise, relax, enjoy nature, and gather for civic discourse, commerce or entertainment. The careful layout of neighborhood public spaces can positively impact physical and mental health, community building and environmental function.

"Parks have long been recognized as key contributors to the aesthetic and physical quality of neighborhoods. Today, we realize that parks are more than recreation and visual assets to communities; they are valuable contributors to larger community policy objectives, such as public health, youth development, job opportunities, social and cultural exchange, and community building... Conserving land for people where they live, work and play is often the most cost efficient and effective way to achieving a host of environmental health and related public policy objectives." *From PenMet Foundation website*

Public space plays an essential role in providing attractive and accessible opportunities for exercise.

A number of studies in the past 10 years conclude that physical activity reduces the risk of heart disease, diabetes, colon cancer, and breast cancer. Evidence exists that it may also improve cognitive functioning and resistance to disease, thereby decreasing the likelihood of entering a nursing home.

In 1998, a Harvard study concluded that a brisk, hour-long walk five days a week cuts the risk of having a stroke almost in half. Even walking 30 minutes a day, five days a week drops the risk by 24%.

Public spaces also provide places for people to gather formally or informally for meetings, festivals, markets, performances or other civic activities. In today's busy world and highly programmed lives, there is a yearning for "old-fashioned" neighborhoods with shared, community spaces where people can enjoy the types of activities that populated traditional town life in years past.

"Public squares are important to cities' social and economic future because they are where people experience their neighborhoods and each other. The benefits go far beyond just making better spaces for people:

Economic and Community Development -

Public squares can catalyze private investment and small scale entrepreneurial activities.

Community Identity -

Squares nurture and define community identity by providing a sense of identity, encouraging volunteerism, and highlighting the values within the community.

Bridge-building -

Squares draw a diverse population, including more women, elderly, and children, as well as a greater ethnic and cultural mix – and encouraging people to get involved and take pride in the area. Public squares are a "common ground." - *From Project for Public Spaces website*

Local Food Production

In addition to recreational and civic uses for public space, there is fast growing interest in use of community space for local food production. Urban agriculture is garnering widespread attention for its potential to provide multiple benefits in the areas of civic life, health and the environmental.

"Health professionals increasingly recognize the value of farm- and garden-scale urban agriculture for nutritional health, personal wellness, urban greening and an engaged and active citizenry."

-From ""Health Benefits of Urban Agriculture" Anne Bellows, Katherine Brown and Jac Smith, 2004.

Sustainability Goals

- To improve personal health through increased physical activity, by providing on site facilities for a variety of active and passive exercise and recreational choices such as recreational walking and biking, informal play, or participation in organized sport activities.
- To encourage the development of (and connections to) biking and walking trails within, to, from and through the site.
- To encourage provision of and/or access to a comprehensive set of public gathering spaces for a full range of civic and community events.
- To provide space for community gardens, local agriculture, and the sale of locally-grown food.

District Sustainability Standards

Minimum Performance Standards

9.1 Comprehensive network of ADA accessible off-road trails for walking and biking throughout the site, connecting the site's major uses and services and public spaces.

9.2 Four programmed sports fields on site.

9.3 One, large outdoor public gathering space for events, picnics, farm market, etc.

9.4 Twice weekly farmers' market on or within one half (1/2) mile of site.

9.5 Three or more indoor public spaces (or private spaces accessible to public use) for community meetings, clubs, parties, etc.

Ultimate Condtions

Each resident shall have potential to receive 60% of their produce from on site food production facilities or gardens during the local growing season, and 20% during the winter months.

1/2 acre civic or passive public space within ¼ mile of 90% of dwellings, and non-residential building entries.

Create community center for public gathering, civic events, and sports & recreational programming for all ages.

Strategies

1. Provide civic or passive public spaces throughout the site.
2. Create programmed sports fields, gyms and recreational facilities for people of all ages.
3. Develop outdoor and indoor public gathering places.
4. Include various passive open spaces, off-road walking paths, and on- and off-road biking trails.
5. Provide community garden space at grade, on rooftops, on indoor and outdoor wall surfaces.
6. Include easily accessible Community Supported Agriculture pick up locations and farmer's market space.
8. Incorporate food production into ornamental/ display landscapes.
9. Include greenhouse space for year-round on-site food production.

Resources

- American Community Gardening Association website includes a wealth of articles on gardening, how to start community gardens, etc. at http://communitygarden.org/
- "APA Policy Guide on Community and Regional Food Planning," American Planning Association (2007) from http://www.planning.org/policy/guides/adopted/food.htm
- Bassett, Jr., D., Pucher, J., Buehler, R., Thompson, D., and S. Crouter. "Walking, Cycling and Obesity Rates in Europe, North America and Australia," *Journal of Physical Activity and Health,* 2008, 5, 795-814 (2008) Human Kinetics, Inc. Retrieved from http://policy.rutgers.edu/faculty/pucher/JPAH08.pdf
- Bellow, A., Brown, K. and J. Smith, "Health Benefits of Urban Agriculture" (2004) from http://www.foodsecurity.org/UAHealthArticle.pdf
- Gardening Matters website has a directory of Twin Cities community gardens, calendar of events, lots of articles on gardening techniques of many kinds at http://www.gardeningmatters.org/
- "Homegrown Minneapolis," Final Report presented to the Health, Energy and Environment Committee of the Minneapolis City Council, (June 15, 2009) from http://www.ci.minneapolis.mn.us/dhfs/hgfinalrec.pdf
- Marcus, C. Cooper, "Shared Outdoor Space and Community Life," Places 15.2: Research & Debate from http://www.designobserver.com/media/pdf/Shared_Outdoor_360.pdf
- Minnesota Institute for Sustainable Agriculture at http://www.misa.umn.edu/
- Permaculture Research Institute – cold climate provides information on permaculture and sustainable practices at http://www.pricoldclimate.org/
- Project for Public Spaces from http://www.pps.org
- "The Surgeon General's Vision for Healthy &Fit Nation 2010," U.S. Department of Health and Human Services from http://www.surgeongeneral.gov/library/obesityvision/obesityvision2010.pdf
- Urban Farming website offers community gardening projects around the United States at http://www.urbanfarming.org/

COMPONENT

10.0 Night Sky Radiation

"Darkness is as essential to our biological welfare, to our internal clockwork, as light itself."

Verlyn Klinkenborg, "Our Vanishing Night," National Geographic, November 2008

Light containment is particularly important at the Ford Site to help preserve the natural beauty, habitat and migratory value of the Mississippi River corridor within which it sits.

Night sky radiation is the emission of light from artificial sources such as outdoor lighting. Excessive levels can affect ecosystem functioning, the health of certain species, and interferes with the human experience of viewing the night sky. Nighttime darkness can be just as important as natural daylight in maintaining a normal circadian rhythm. Many species of wildlife operate specific internal cycles or rhythms that help them determine when to initiate foraging, migratory or reproductive behavior. The addition of artificial light to the nighttime environment disrupts the precision of these cycles, thus modifying behavior. This can expose them to higher predation levels or disrupt their navigational abilities.

Artificial illumination of the sky during the night uses additional and unnecessary energy when the light could be directed to the ground where it is needed. Various estimates suggest that lighting accounts for about 8–9% of the electricity used in the United States, a percent which could be lower if lighting fixtures focused their energy on downward illumination.

Sustainability Goals

- To reduce light emitted from site to the sky at night.
- To protect the environments of predator and prey.

This satellite image of the United States at night from space (NASA) illustrates electrical energy cast into the sky beyond its useful range, wasting billions of watts of energy.

District Sustainability Standards

Minimum Performance Standard

10.1 The average phototropic lumens for the entire site shall be 40,000 lumens per net acre using full-cutoff (fco) lighting, with no one individual area of the site exceeding 70,000 lumens/net acre.

Ultimate Conditions

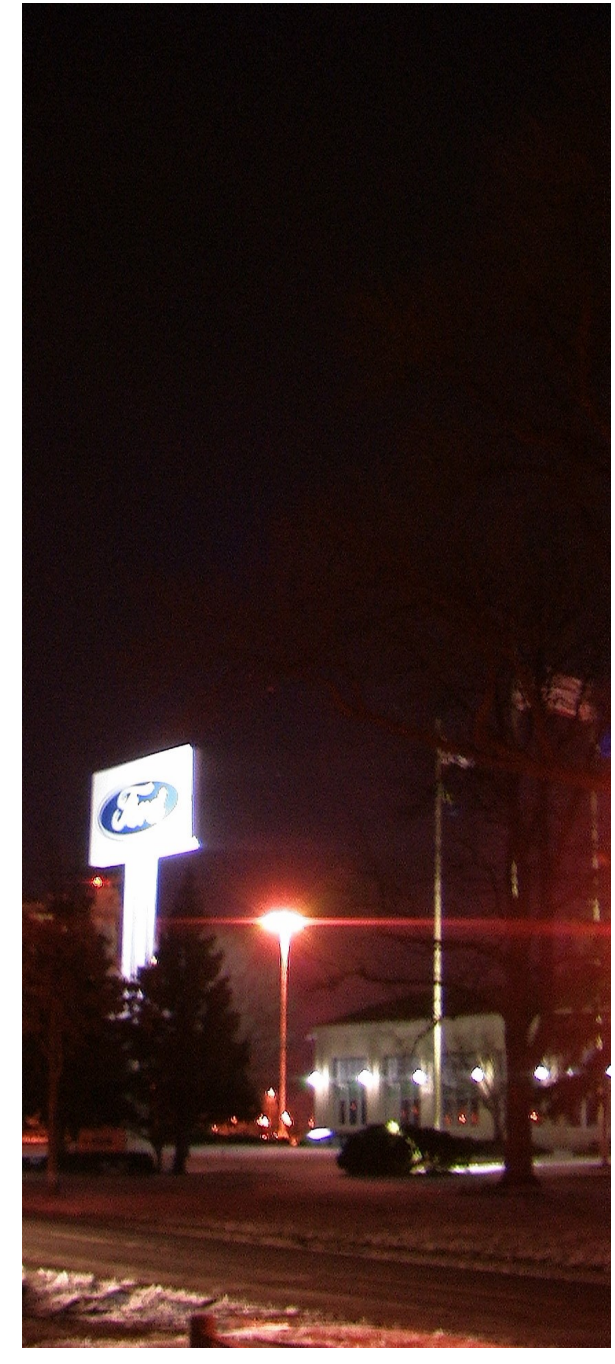
The average phototropic lumens for the entire site shall be 10-20,000 lumens per net acre using full-cutoff (fco) lighting with no one individual area of the site exceeding 40,000 lumens/net acre.

Strategies

1. Locate and direct lighting only where and when lighting is necessary.
2. Only use as much light as needed – do not overlight an area for security reasons.
3. Use energy efficient bulbs that use the least amount of energy for the right amount and quality of light needed.
4. Use motion detectors and light timers where lighting is needed only periodically.
5. For all lighting on site, use full cut-off luminaires that are designed or shielded in such a manner that all exterior light rays emitted by the fixture are projected below a horizontal plane running through the lowest point on the fixture, so that no light rays are emitted at angles above a horizontal plane.
6. Minimize reflective surfaces on the ground and buildings to help reduce light reflected into the night sky.

Resources

- Beginners' Guide to Lighting Regulation and Directory of Lighting Regulations available at http://www.darksky.org/mc/page.do?sitePageId=58882
- Georgia Power helps you comply with Night Sky from http://outdoorlighting.georgiapower.com/docs/Bright%20Ideas%20Summer%2007.pdf
- Minnesota B3 Guidelines, Site and Water sections from http://www.msbg.umn.edu/
- "Outdoor Lighting Code Handbook" International Dark Sky Association (2002) from http://data.nextrionet.com/site/idsa/Lighting%20Code%20Handbook.pdf
- "Outdoor Lighting Practices in the State of Indiana," Indiana Council on Outdoor Lighting Education from http://www.utahskies.org/lightpollution/indianalights.pdf
- "Preserving our Night Sky," Report for the City of Twentynine Palms (1987) from http://www.ci.twentynine-palms.ca.us/fileadmin/user_upload/pdf/night_sky_ord.pdf



COMPONENT

11.0 Urban Heat Island

"The climate in cities is greatly affected by human activities and the creation of the urban landscape."

"The Urban Heat Island, Photochemical Smog and Chicago", PK Gray and M. Finster

As urban areas develop, land that was once permeable and moist becomes impermeable and dry. These changes in the land surface create a micro-climate know as the urban heat island effect.

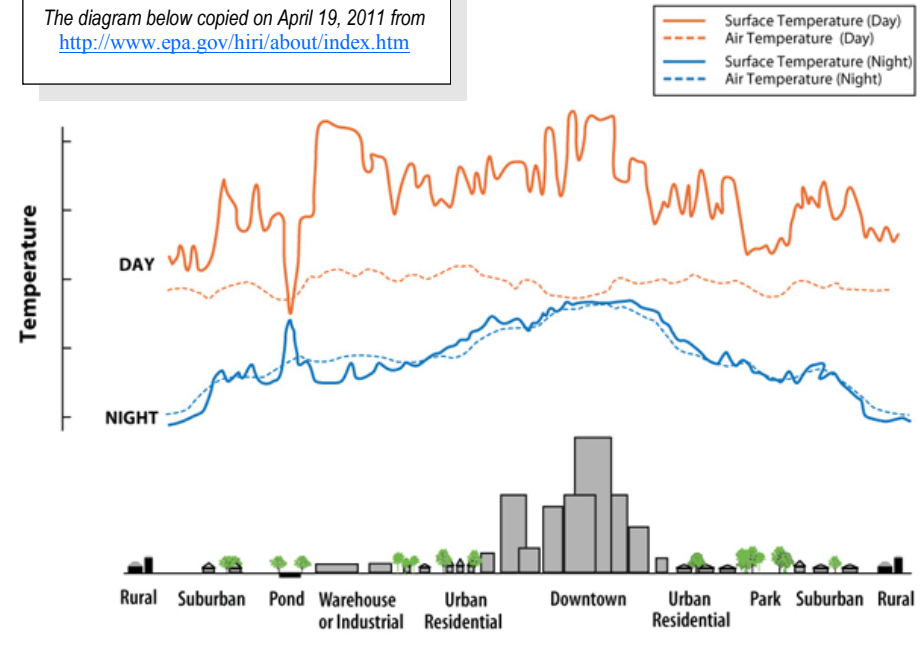
The urban heat island effect results in temperatures in urban areas that are two to eight degrees Fahrenheit higher than surrounding rural or suburban areas.

The causes of heat islands are the color and mass of man made structures (both buildings and ground surfaces) and the reduced evapotranspiration and cooling effects from vegetative cover, which is sparse in typical urban areas.

The higher temperatures in a heat island are problematic for a variety of reasons. From an energy standpoint, they require additional air conditioning in urban buildings, particularly at peak times. The increased use of electrical cooling causes additional greenhouse gas emissions from the generation plants. Higher urban temperatures also cause lower air quality (N20 and VOCs create more ground layer ozone at higher air temperatures), and additional stress on human health, from pollution related illnesses and even death on peak heat days. Urban Head Island can cause an increase in rainfall as well, which exacerbates the stormwater capacities of cities, causing flooding and pushing untreated drainage overflows into lakes streams and rivers.

Addressing urban heat island effects is a growing priority as cities, businesses and residents try to contain soaring energy use and costs associated with cooling. At the site, block and neighborhood level, Saint Paul is seeking building, streetscape and infrastructure designs to reduce urban heating.

The diagram below copied on April 19, 2011 from http://www.epa.gov/hiri/about/index.htm



District Sustainability Standards

Minimum Performance Standard

11.1 Average surface albedo for the entire site greater than 0.1.

Ultimate Condition

Average surface albedo for the entire site between 0.15-0.3 .

Sustainability Goals

- To reduce urban heat island effects on site by reducing the heat absorption of materials used in buildings, landscaping and infrastructure.
- To increase vegetative cover to help keep the site and buildings cool in the summer.
- To reduce the need for air conditioning and irrigation in the summer.

Strategies

1. Use lighter, less dense exterior building materials to reduce the heat capacity of surfaces.
2. Use best available, low albedo materials for streets, sidewalks, parking lots and other hardscape surfaces.
3. Use additional building insulation to reduce energy consumption for air conditioning and heating.
4. Increase vegetative cover on the site to increase cooling effects, reduce stormwater runoff, increase water quality and slow runoff rates.

Resources

- "Five Years Later, Rouge Remains Touchstone for Green Projects Around the World" Ford Motor Company (2008) from http://world-wire.com/news/0806180001.html
- Minnesota B3 Guidelines, Site and Water sections from http://www.msbg.umn.edu/
- "PROFILE OF SUCCESS ENERGY STAR Labeled Roof Products Case Study" from http://www.energystar.gov/ia/partners/manuf_res/OurSaviors_new.pdf
- Rosenfeld, A., Romm, J., Akbari, H.., Pomerantz, M. and H. Taha, "Policies to Reduce Heat Island: Magnitudes of Benefits and Incentives to Achieve Them," U.S. Department of Energy and Lawrence Berkeley National Laboratory (1996) from http://eetd.lbl.gov/EA/Reports/38679.pdf
- Urban Heat Island Resources from the Environmental Protection Agency available at http://www.epa.gov/heatisland/resources/index.htm

Surface Albedo

Albedo is the fraction of solar energy (shortwave radiation) reflected from the Earth back into space. The greater the surface reflectivity, the less of the sun energy is retained in the material and is reradiated to the surrounding environment, e.g. snow (1.0) versus asphalt (0.1). Total site albedo can be calculated by determining the albedo of all materials and vegetation that are exposed to the sun's radiation and then averaging the sq ft and the albedo across the site. Example: (Square foot of roof)(albedo) + (Square foot of paving)(albedo)+ (Square foot of vegetation)(albedo) etc./ by the number of surfaces included above. To determine the albedo of surfaces see: Solar Reflectance or Albedo of Selected Materials Surfaces.

Although "Albedo" is the metric for reflectivity, developers should note the inherent heating capacity of the building and site material as well. Heavier, denser and darker materials will have a larger capacity to absorb, retain and re-radiate energy as oppose to thinner material with the same albedo. Therefore, the color and embodied heat capacity of building and site materials is important as well.


Mississippi
River
Ford

Implementing Sustainability
Four Strategies

This section includes information that is critical for transforming the vision described in the previous section into reality, including essential background, implementation strategies, polices, and incentives. The following pages describe implementation strategies that the City should research in more detail and consider adopting in some manner.

1

The Integrated Design Process

Sustainable building and site design are important and increasingly complex, causing an increase in the sophistication of integrated building and site design approaches in the building and development industry. Integrated design is a process in which nearly every aspect of design is planned and coordinated in a manner that permits synergistic and unlikely benefits to be realized.

Integrated design is multi-disciplinary and collaborative, involving designers of all major site systems from energy; buildings, transportation, water services, stormwater, waste water; to open space and recreation planning.

The team members begin their collaboration in the earliest possible conceptual site planning and design phases, identifying how to best achieve green and sustainable design goals for their system and for the site. The team actively identifies where their systems overlap and how to adjust the design for each component to best support the green design opportunities for the other components. For instance, a street grid orientation should be informed by the building design group's interest in optimal solar access. Likewise, the open space system designers should be in active conversation with the low impact stormwater system planners to identify shared space opportunities. The integrated design team will address all major design issues and develop a work plan early in the design process.

More creative, cohesive, and sustainable results are achieved through the integration of team members, clients, and stakeholders into all phases of the design process; from site analysis, to conceptual design, and through to final construction documents.

Integrated design allows for a cross pollination of disciplines which generates innovative ideas and outcomes. Significant savings are often realized through such a process because there is the opportunity to identify a design for each component of the site in a manner that compliments, simplifies or shares systems with other components.

An integrated design process requires a larger time commitment in the early planning stages than a typical site design approach. Site developers, designers and stakeholders should be prepared for this commitment and set aside time up front for this work. Ultimately, a well organized, integrated design phase early in the process will provide a clear work plan and avoid delays later in the process.

The City of Saint Paul should assist the developer in seeking and securing green consulting, coordination and design assistance from an entity that has experience in integrated design processes, a long-term commitment to the project, and some decision-making authority over the team.

In order to support an integrated design process for the site, City of Saint Paul staff must likewise organize a cross-disciplinary team to support the site planning and design work. Core staff from public works, zoning, planning and economic development, parks, and water services will work together to identify and address issues that arise and provide a project lead who interacts with the development team and directs City staff activities for the project.

Integrated Design Resources

ww.aia-mn.org—AIAMinnesota Committee on the Environment—Sustainable Integrated Design http://www.aia-mn.org/int_committees/cote.cfm

National Charrette Institute—"Charrettes for Development Projects" http://www.charretteinstitute.org/projects/development-projects.html

International Initiative for a Sustainable Built Environment—"The Integrated Design Process", http://www.iisbe.org/down/gbc2005/Other_presentations/IDP_overview.pdf

2

Form Based Development Code

The City of Saint Paul is built in the traditional model of historic Midwestern cities – a central downtown surrounded by distinct residential neighborhoods with their own commercial main streets. The City is primarily oriented on a large grid, block pattern, and interspersed with parks, churches, schools, roadways, and occasional industrial areas.

The Current Regulatory Context

The zoning districts and regulations for the City generally reflect the built form, but focus on land use more than on design and function. Sometimes the zoning code more strictly prohibits what is allowed than what is observed in the historic form of the City. Because the city's zoning districts attempt to create distinct land use zones, many non-conforming historic uses remain throughout the city.

The City's zoning code and use designations serve the needs of the City for the most part, however, the traditional zoning approach may both over-regulate uses and under-serve the design and performance opportunities for a redeveloped Ford site. The sustainability

performance standards outlined in this report will be minimally advanced by the City's current zoning approach and may in parts be impeded by it. For example, this report encourages flexibility in building and space use over time, to enable the site to adjust to the desires of the community and needs of the marketplace in order to remain vibrant. Use based zoning designations, successful in separating uses, is less successful as a tool for the implementation and regulation of more mixed use, sophisitcated, walkable urban patterns. Market flexibility is also reduced with use based zoning, as it often requires regulatory approval for even slight changes in use. Current zoning does not regulate operations such as site-wide walkability, site-wide wastewater, recycling or on-site energy generation, all of which are recommended in this report.

In order to achieve the range of performance thresholds for sustainable redevelopment in this report, a different type of zoning approach for the site may be necessary.

Form Based Regulation

The Ford Site Sustainable Redevelopment team identified flexible land and building use over time as a key goal for the site. To remain vibrant and successful, a neighborhood must be able to adapt to the changing needs and desires of its residents and visitors. Often times this means changing the way a building or space is used, which may be prohibited under traditional, single-use zoning. The team recommends that the sustainability thresholds set for the site be achieved through design, while use is allowed to be somewhat fluid through the support of a form-based code.

The Form-Based Codes Institute provides the following information on form-based codes:

> *"Form-based codes are a method of regulating development to achieve a specific urban form. Form-based codes create a predictable public realm primarily by controlling physical form, with a lesser focus on land use, through city or county regulations. Form-based codes commonly include the following elements:*
>
> ***Regulating Plan**. A plan or map of the regulated area designating the locations where different building form standards apply, based on clear community intentions regarding the physical character of the area being coded.*
>
> ***Public Space Standards**. Specifications for the elements within the public realm (e.g., sidewalks, travel lanes, on-street parking, street trees, street furniture, etc.).*
>
> ***Building Form Standards**. Regulations controlling the configuration, features, and functions of buildings that define and shape the public realm.*
>
> ***Administration**. A clearly defined application and project review process.*
>
> ***Definitions**. A glossary to ensure the precise use of technical terms.*
>
> *Form-based codes also sometimes include:*
>
> ***Architectural Standards**. Regulations controlling external architectural materials and quality.*
>
> ***Landscaping Standards**. Regulations controlling landscape design and plant materials on private property as they impact public spaces (e.g. regulations about parking lot screening and shading, maintaining sight lines, insuring unobstructed pedestrian movements, etc.).*
>
> ***Signage Standards**. Regulations controlling allowable signage sizes,*

"Form-based codes are a method of regulating development to achieve a specific urban form. Form-based codes create a predictable public realm primarily by controlling physical form, with a lesser focus on land use, through city or county regulations.

Form Based Codes Institute
http://www.formbasedcodes.org/definition.html

materials, illumination, and placement.

***Environmental Resource Standards**. Regulations controlling issues such as stormwater drainage and infiltration, development on slopes, tree protection, solar access, etc.*

***Annotation**. Text and illustrations explaining the intentions of specific code provisions."*

- Form Based Codes Institute, from http://www.formbasedcodes.org/definition.html

A form-based code overlay could be developed during the integrated design process with input from the developer, the interdisciplinary project team and City staff. If agreed to by all parties, this code overlay would be adopted by City officials in place of the City's regular zoning designations. It is likely that the expertise of a form-based code consultant would be necessary to lead the discussion and create the site code.

3

Green Building Standards, LEED for Neighborhood Development & Other Policy Frameworks

A number of existing and soon-to-be-adopted sustainable design policies and accreditation programs will and could apply to the Saint Paul Ford site. The City of Saint Paul must carefully evaluate the requirements in each policy compared to the sustainability thresholds described in this report and determine the role each could play in helping to implement the Ford site sustainable redevelopment agenda.

Saint Paul Green Building Policy

This policy, adopted in 2010, applies to all new construction projects receiving $200,000 or more in City financing. The projects would be required to be certifiable or compliant under one of the following existing green building rating programs, including:

- LEED NC or H, Silver
- Green Globes, 2 globes
- State of Minnesota B3 Guidelines
- Saint Paul Port Authority Green Design
- Minnesota Green Star, Silver
- Green Communities, MN Overlay

Projects are also required to meet a specific set of requirements related to predicted energy use, predicted water use, construction waste, environmental air quality, predicted greenhouse gas emissions, stormwater management and energy benchmarking.

Capitol Region Watershed

http://www.capitolregionwd.org/rules.html

The Ford site falls within the Capitol Region Watershed management area and is subject to its required permitting procedures under Rule C for stormwater management and Rule F for erosion and sediment control which apply to all projects over one acre in size. The Capitol Region standards are considered by many to be strong and successful at compelling the use of best practice stormwater management techniques to achieve the requirements.

Sustainable Stormwater Report

http://www.stpaul.gov/DocumentView.aspx?DID=12751

In 2009, Barr Engineering researched the potential for using stormwater best management practices (BMP) at the Saint Paul Ford site. Their report, *Sustainable Stormwater Feasibility Report for the Ford Plant Site,* was funded as a companion project to this report by the Minnesota Pollution Control Agency. The report provides a comprehensive overview of opportunities, limitations and recommendations for implementing a comprehensive BMP stormwater system as the Ford site redevelops. This report should be used as a guide for future planning of the site.

LEED for Neighborhood Development

http://www.usgbc.org/nd

While there exist a variety of sustainability standards for development at the building scale, there is currently only one that addresses sustainable development at the site or neighborhood scale, LEED-ND. The thresholds described in this report closely coincide with LEED-ND. Therefore, utilization of the LEED-ND system during design will go a long way to achieving these thresholds and is highly recommended.

Like the sustainability goals for the Ford site, LEED-ND primarily employs prescribed goal outcomes and does not dictate specific strategies to attain those outcomes. The standards in this report reflect specific and aggressive approaches that take into consideration the nuances of municipal, county and state standards and regulations, whereas LEED-ND is an emerging national standard and may at times not match the standards set in this report. It is suggested that LEED-ND be used as a tool to augment and realize the goals suggested in this report, instead of replacing them.

There is potential that both LEED-ND standards, as well as the specific standards and policies in this document, could be used to construct methods for setting performance thresholds tied to incentives, conditions for monetary or grant support, or for reductions in certain development fees (feebates) from various agencies.

For reference, see United States Green Building Council 2009, Guide to Local and State Governments - Using LEED for Neighborhood Development as a Policy Tool to Encourage Sustainable Development.

4

Incentives

Designing and developing a highly sustainable site will require a strong level of commitment from the development team and potentially higher initial costs for project design and construction. The expected payback is higher building market values and demand for the properties; lower operating costs; extended life; and increased worker productivity. The City of Saint Paul

While there exist a variety of sustainability standards for development at the building scale, there is currently only one that addresses sustainable development at the site or neighborhood scale; LEED-ND.

should evaluate possible incentives linked to developing a highly sustainable Ford site. A variety of non-monetary incentives have been used by cities seeking similar green design goals for projects and some of these may be appropriate to the Ford site project. Financial incentives are uncertain at this time, due to economic challenges for state and local governments, but will be examined.

Monetary Incentives

Direct financial incentives used to drive sustainable development should be evaluated for potential and appropriateness under local circumstances and for this project. These may include tax breaks, grants, loans, bonding, or fee-bates.

Taxes

There are two main tax strategies to be evaluated for applicability to this project. Tax shifting can reduce the tax burden for design that mitigates or eliminates impacts while increasing it for higher impact designs requiring City operations (Public Works, Sewers, etc.). Alternatively, property tax credits or exemptions can be considered.

Grants & Loans

Grants, matching grants or other direct financial incentives from private foundations, utilities, and government agencies may be available.

Bonding

Project bonding tied to performance or certification targets. Bonding may be used to create a legacy revolving loan fund or pool for green programs on the site or more broadly.

Feebates

A shift in costs and incentives that more accurately reflect the hidden costs and benefits of traditional and sustainable development. In today's marketplace, many of the long-term costs associated with unsustainable development, such as air and water pollution, are not accounted for and included in the initial cost of development. Feebates, which are growing in use around the world, work to offset long-term expenses by building these costs into initial expenditures, or alternatively, discount the cost of items that will have few long-term impacts. Feebates recognize the sum of short- and long-term costs and make sure that these are reflected in the marketplace, thereby providing a clearer

choice and incentive for the consideration of sustainable practices that have lower long-term impacts.

Non-Monetary Incentives

Indirect financial incentives typically include technical assistance with planning and/or certification processes, streamlined review and permitting that reduces the development timeframe, marketing and PR services, and density bonuses.

City of Saint Paul staff must examine where the greatest benefit in non-monetary incentives is to be gained in relation to the City's typical code requirements and development review and permitting processes.

Receipt of incentives should be tied to specific project requirements and outcomes that are easily understood and measured by the developer and the financing entity. Penalties for failure to achieve outcomes should be enforced through legal contracts and may result in withheld funding, payback requirements, or the loss of other agreed to incentives.

Next Steps

#1 Engage Ford and community stakeholders in a review of these standards.

Share this report and its recommendations with the land owner, community members, City staff from various departments, and other agencies and stakeholders. Identify areas of common interest, priorities, questions and issues. Use this input to inform the setting of priorities and preferred implementation strategies.

#2 Link standards to incentives.

The City of Saint Paul should begin work now to draft a thoughtful set of possible financial and non-monetary incentives that are linked to clearly defined performance outcomes.

#3 Consider drafting additional categories of District Sustainability Standards.

The twelve policy categories included in this document focus on site-wide design and physical sustainability of several measurable systems such as energy, water and soil. Other categories of sustainability were considered as well, but were not included either because they didn't relate to site-wide design or require a deeper level of evaluation and goal setting once general site reuse is identified. (*See list at right.*) It is recommended that this document be reviewed periodically, for potential addition of new sustainability categories and revision of standards to incorporate new science and new best practices. >

#4 Engage an integrated design team to develop a preliminary long-range site regulating plan for new public right of ways & infrastructure improvements.

The City of St Paul can provide predictability for future investments in public infrastructure and for private (re) development on the site by collaborating with the community, landowners and stakeholders on the establishment of a long-range site regulating plan for public realm. (See Form Based Code section.) This would allow for gradual, incremental redevelopment of the site in a sensitive but coordinated manner by creating a rational framework for careful extension of the urban fabric onto the site.

SAINT PAUL
The Most Livable City in America

DISTRICT SUSTAINABILITY STANDARDS

Additional Components to be Considered...

Eco-Industrial Development

Education & Training Facilities

Land Use & Housing Diversification

Economic Viability

Arts & Culture

Employment

Safety