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Getting Green to Work in the Northwest Industrial District

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Getting Green to Work
In the Northwest Industrial District

A PLAN FOR
IMPROVING LOCAL
ENVIRONMENTAL
QUALITY WITH GREEN
INFRASTRUCTURE

Prepared by MFGreen for
City of Portland Bureau of Environmental Services
+ The Forest Park Conservancy

JUNE 2015
ABOUT THE PLAN

Getting Green to Work is a plan for improving environmental quality in the Northwest Industrial District with green infrastructure and other voluntary approaches. Getting Green to Work was prepared by MFGreen (Manufacturing Green) in partnership with the City of Portland Bureau of Environmental Services and Forest Park Conservancy.

MFGreen (Manufacturing Green) consists of six Master of Urban and Regional Planning students at Portland State University.

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This plan fulfills requirements of the MURP Planning Workshop, their culminating degree experience.

USING THE PLAN

The purpose of the Plan is to provide context and information in support of recommendations for place-based remedies to improve local environmental quality that were identified through outreach and analysis. This plan is intended for use by the City of Portland Bureau of Environmental Services and Forest Park Conservancy in ongoing and future planning efforts. It is also intended to aid the Northwest Industrial Neighborhood Association, firms and local non-profit organizations in identifying and applying for funding opportunities.

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LIST OF ACRONYMS

**AASHTO**  American Association of State Highway and Transportation Officials

**BES**  City of Portland Bureau of Environmental Services

**CEID**  Central Eastside Industrial District

**DEQ**  Oregon Department of Environmental Quality

**EPA**  Environmental Protection Agency

**FPA**  Forest Park Association

**FPC**  Forest Park Conservancy

**GFPCI**  Greater Forest Park Conservancy Initiative

**GNA**  Good Neighbor Agreement

**MURP**  Master of Urban and Regional Planning

**NINA**  Northwest Industrial Neighborhood Association

**NWID**  Northwest Industrial District

**ORS**  Oregon Revised Statues

**PSU**  Portland State University

**PWMP**  Portland Watershed Management Plan

**SMM**  Stormwater Management Manual

**TMA**  Transportation Management Association

**TSP**  Transportation Systems Plan
Chapter 1
Introduction

CONTEXTUALIZING THE PROJECT + STUDY AREA
Overview of Getting Green to Work

Forest Park and its surrounding watershed experience measurable environmental problems such as urban heat island impacts, increased stormwater runoff containing pollutants, fragmentation of habitat connectivity due to their proximities to high-impact land uses, poor air quality, absence of public space, and lack of pedestrian and bicycle infrastructure.

With these concerns in mind, MFGreen, a team of graduate students from the Master of Urban and Regional Planning program at Portland State University, worked with the Forest Park Conservancy, City of Portland Bureau of Environmental Services and Northwest Industrial neighbors to draft Getting Green to Work in the Northwest Industrial District.

The purpose of Getting Green to Work is to identify strategies to address environmental issues that affect local human and environmental health in the Northwest Industrial District, Forest Park and the Willamette River while benefiting local businesses, workers and firms.

Getting Green to Work explores voluntary approaches to address local environmental problems with green infrastructure and other place-based remedies. We engaged industrial site owners and managers, and technical advisors to determine where greatest environmental benefit is achievable and what opportunities and obstacles exist to implementation. Building on this information, final recommendations suggest priorities for expanding green infrastructure on private and public lands in the Northwest Industrial District.
PROJECT AREA

Getting Green to Work focuses on the Northwest Industrial District, which includes Guild’s Lake Industrial Sanctuary. Located northwest of downtown Portland, Oregon, this heavily industrial area is bounded by the Willamette River and Forest Park, two of Portland’s most valuable natural resources. Outreach and analysis for this project focused on land falling under purview of the Northwest Industrial Neighborhood Association. The NINA area includes land between the Willamette River and U.S. Highway 30, from NW Nicolai St. and the I-405 bridge in the south to St. John’s Bridge in the North.

Data used: Orthophoto, Tax Lot, Building, Vegetation, River, Stream, NWID
Sources: Metro RLIS, Portland State University, City of Portland
Industrial Workforce

The Northwest Industrial District is one of the few remaining large industrial areas near the downtown core of a major U.S. city. While close proximity to the downtown core creates opportunities for workers to find nearby housing and access urban amenities, it also increases the area’s development potential for competing uses. Industrial land uses provide family wage jobs and have a multiplier effect, helping the rest of the economy grow. Considering their economic value, it is critical to keep industrial land uses. In 2001, the City of Portland created the Guild’s Lake Industrial Sanctuary to do just that—preserve the industrial area for industry.

INDUSTRIES

Over 80% of jobs in the Northwest Industrial District fall under the following three industry groups: Manufacturing (41% of all jobs), Wholesale Trade (28% of all jobs), and Transportation and Warehousing (11% of all jobs). These three industry groups constitute only 17% of total jobs in the City of Portland.

WAGES

Almost 60% of jobs in the Northwest Industrial District earn at least $3,333 per month, or roughly $40,000 or more per year. Another third of the jobs earn between $1,750 and $3,333 per month. The percentage of the top segment is remarkable considering that across the City of Portland, only 47% of jobs offer wages of $3,333 or more per month.

EDUCATION

As is typical for industrial jobs, educational attainment of workers is lower than the average for the city as a whole. While 29% of people working in the City of Portland hold a Bachelor’s degree or higher, only 23% percent of workers in the Northwest Industrial District hold Bachelor’s degrees or higher. Correspondingly, a greater percentage of workers in the Northwest Industrial District have a high school degree (26%) than citywide (18%). When viewing the city through an affordability lens, the importance of available higher paying jobs for people with lower educational attainment should not be understated.

GENDER

Historically, industrial work has been predominantly male; however, a significant proportion of women are employed in the area. As of 2010, women constituted 21% of all workers in the Northwest Industrial District.

COMMUTE DISTANCE

While the Northwest Industrial District is within close proximity to the urban core, only 46% percent of area workers live within 10 miles. Another 40% of live between 10 and 24 miles from the Northwest Industrial District. In comparison, 63% of workers live within 10 miles of their workplaces in the City of Portland at large, and only 37% live more than 10 miles from their workplaces. Long commute distances for industrial workers may be symptomatic of the increasing costs of living near Portland’s downtown core. Demand for affordable housing may push certain workers to look for housing further afield than would be otherwise desired. Hillsboro, Beaverton, St. Helens and Scappoose are affordable areas further out where many Northwest Industrial District workers live.

RELEVANCE TO THIS PLAN

Understanding workforce characteristics provides context about who is affected by local environmental issues and who will be affected by outcomes of Getting Green to Work. Therefore, we should be cognizant of the major group, middle-income male industrial workers, but also smaller groups, such as female workers and business owners.
Precedent Plans

Strategies suggested in Getting Green to Work are rooted in various precedent plans. The following seven plans provide the guiding framework and background for this project and report:

- **Willamette Subwatershed Improvement Strategies** (ongoing)
  Portland Bureau of Environmental Services

- **Portland Climate Action Plan** (2015 update)
  Portland Bureau of Planning and Sustainability

- **Portland 2035 Comprehensive Plan** (2014)
  Portland Bureau of Planning and Sustainability

- **Greater Forest Park Conservation Initiative (GFPCI)** (2013)
  Forest Park Conservancy

- **The River Plan** (2006 Concept)
  Portland Bureau of Planning and Sustainability

- **Portland Watershed Management Plan** (2005)
  Portland Bureau of Environmental Services

- **Guild’s Lake Industrial Sanctuary Plan** (2001)
  Portland Bureau of Planning

We examined these plans with implications for the Northwest Industrial District and improving local environmental quality. The following key themes emerged which are emphasized in Getting Green to Work:

- **Jobs and economic development** - including green jobs, a prosperous and competitive working harbor, vibrant waterfront districts and neighborhoods

- **Healthy watershed** - including streams, a clean and healthy river, water quality, stormwater management, floodplain conditions, and hydrology

- **Urban forestry** - including wildlife, habitat, revegetation, biological communities, and natural environmental systems

- **Connectivity** - as it relates to transportation, urban form, and mobility

- **Community engagement** - including collaboration, partnerships, leadership, education, and stewardship

**CONNECTION WITH PAST PLANNING EFFORTS**

Several plans target major environmental resource areas in the Portland Metro area. These plans focus on protecting critical habitat areas, reducing further degradation of these ecosystems, and repairing existing damage. Among these plans, the Greater Forest Park Conservation Initiative is particularly significant given the proximity of the Northwest Industrial District to Forest Park, and our client’s affiliation.

The Greater Forest Park Conservation Initiative, created in 2013, sets goals around four primary features that are key to the health of Forest Park and its complex ecosystem. Primary emphasis is put on protecting, maintaining, and improving the quality of these features.

- **Streams**: Protecting streams is critical for watershed function as well as human health.

- **Connectivity for habitat**: Forest Park is a key connection point for wildlife between regional natural areas like the Coast Range and the Western Cascades.

- **Forests**: Forests sequester carbon and provide other numerous ecosystems and social benefits.

- **Wildlife**: Wildlife diversity is essential to a healthy and stable ecosystem, preventing the harmful dominance of any particular species.

In addition to conservation efforts inside Forest Park, the GRPCI calls for conservation efforts outside of Forest Park, encouraging engagement with Forest Park’s neighbors. Getting Green to Work is a major next step to encourage necessary efforts outside of Forest Park to achieve the GFPCI’s goals. Broad membership of the Forest Park Alliance, involved in the creation of the GFPCI and consulted during this project, will play a large role in the implementation of this plan.

**The River Plan** splits the Willamette River into three sections in Portland: the North Reach, Central Reach, and South Reach. The Northwest Industrial District is located within the North Reach. The River Plan envisions a bikeway and pedestrian system that continues through the North Reach, using off-street trails, on-street bicycle lanes, and sidewalks. It also calls for the construction of a new bicycle and pedestrian path to connect both sides of the river with St. Johns Bridge, the railroad bridge, or a new bridge crossing the Willamette. A West Reach River Plan is also being planned, but has not yet been adopted.
A particularly important link to this project is the Portland Climate Action Plan, “a strategy to put Portland and Multnomah County on a path to achieve a 40 percent reduction in carbon emissions by 2030 and an 80 percent reduction by 2050 (compared to 1990 levels).” In 2008, the industrial sector produced 15% of total greenhouse gas emissions in Multnomah County.

In the Climate Change Preparation section, Objective 17 states: “Adapt successfully to a changing climate.” Green infrastructure is recognized as a tool for climate adaptation. The Climate Action Plan defines green infrastructure as that which uses natural processes, systems or features to provide traditional infrastructure services. There are two primary types of green infrastructure:

- **Natural networks of streams, rivers, and open spaces** that naturally manage stormwater, provide habitat, improve air and water quality, reduce flooding risk, and provide areas for human recreation and respite; and
- **Engineered facilities**, such as green street treatments or eco-roofs, which use natural processes in an infrastructure setting.

This plan contributes toward reaching goals of the Climate Action Plan through recommendation of green infrastructure.

The Portland Watershed Management Plan sets watershed health goals around hydrology, physical habitat, water quality, and biological communities to protect and restore Portland’s freshwater resources back. It created an extensive program implementation framework with three interagency working groups to ensure that programs are effective and their implementation is shared among city departments. Connecting recommendations from Getting Green to Work to the agendas of these working groups can aid in project implementation as well as contribute to meeting the watershed health goals.

The PWMP has already promulgated some green infrastructure work in the Northwest Industrial District, including green infrastructure projects, including some green street facilities, along NW 35th Avenue in the Northwest Industrial District, and green street facilities along NW Front Avenue in the Northwest District to the south. Green streets emerge as a priority per this plan. The PWMP recognizes that green streets with bioswales, low-growing native and ornamental plants make attractive neighborhood amenities in addition to diverting stormwater from the sewer system to reduce combined sewer overflows. Green streets increase stormwater infiltration, which reduces stormwater pollution in rivers and streams. Green street targets and other synergies with the PWMP were specifically examined in this project.

BES’s updated **Stormwater Management Manual** plays a large role in implementing green infrastructure in the Northwest Industrial District. The SMM “provides design and policy requirements for stormwater management throughout the City of Portland.” Applicable to nearly all additional development or redevelopment within the City’s industrial areas, these requirements will steadily modernize the stormwater system and improve stormwater quality in the industrial area to meet City goals.

**RELEVANCE TO THIS PLAN**

These precedent plans provide important background and context for implementing green infrastructure in the Northwest Industrial District. Getting Green to Work seeks to build off of these plans by meeting concurrent goals to address existing environmental issues while preserving industrial uses.
CHAPTER REFERENCES


3. Ibid
4. Ibid
5. Ibid
6. Ibid
7. Ibid
This chapter explores environmental priorities to be addressed through green infrastructure and other voluntary approaches. Analysis of issues focused on the role of the industrial district in creating or perpetuating observed environmental issues. Geospatial analyses were conducted to identify areas within the Northwest Industrial District where types of green infrastructure strategies provide the most potential benefit. Specifically, this chapter looks at the following local environmental issues: air quality, urban heat island, stormwater quality, and habitat connectivity for wildlife, as well as social dimensions of these issues.
Air Quality

Human activities in urban and industrial areas are major sources of air pollutants that drive regional air quality. Air quality varies across the Portland metropolitan region, depending, in part, on proximity to road, and industrial sources. Air toxics, including diesel, soot, benzene, PAHs and heavy metals, can cause serious human health problems, and harm the environment. Toxic air pollution, part of a larger air quality issue, is a significant problem in the Portland region which affects populations disparately, depending on vulnerability and exposure levels.

GEOGRAPHIC EXTENT

The Northwest Industrial District is a regional hotspot of toxic air pollution, largely resulting from concentrated vehicle, freight and industrial emissions and geographic and climatic conditions. Air toxics benchmarks are determined by the State of Oregon and are based on concentrations that individuals could breathe continuously over a lifetime without increasing their cancer risk. This map shows geographic dimensions of specified air toxics within the Northwest Industrial District and beyond. The Southern reach emerges as a high priority area, characterized by high annual cumulative benchmark exceedances.

CONNECTION TO INDUSTRY

Prevention and mitigation of air pollution are important and effective ways to address air pollution related issues. Industrial facilities and freight movement in the Northwest Industrial District produce emissions that contribute significantly to regional air quality problems. Certain emissions produced by industrial facilities are fairly unique for the region. Given their uniqueness, several technical advisors during the course of this project noted opportunities for researching remedies and targeting prevention work.

In the past, Oregon Department of Environmental Quality employed technical assistance staff to help private firms voluntarily reduce their emissions or alter their emissions patterns. The technical assistance program disappeared with budget cuts in recent years resulting in the unmet need observed today.

Good Neighbor Agreements have been used to mitigate air quality-related issues from specific emissions sources in the Portland region. ESCO Corporation, located in the Northwest Industrial District, has a Good Neighbor Agreement in place. Per their agreement, an air quality monitoring device was installed at Chapman School and provides ongoing monitoring of air quality south of the Northwest Industrial District, where air pollution is most heavily concentrated.

Business owners and managers consistently identify air quality related issues as top concerns and priorities to address.
Urban Heat Island

As urban areas develop, buildings, roads and other infrastructure replace open land and vegetation, and permeable, moist surfaces become dry and impermeable. These changes cause urban regions to become warmer than their rural surroundings, forming what is known as an urban heat island. Urban heat islands have human health impacts, affect urban air pollution, alter weather patterns and affect energy consumption at the city-scale. Within a region, urban heat island magnitudes differ based on tree canopy cover, roadway density, and land use. Warmer areas within a city are usually associated with industrial and commercial land uses.

GEOGRAPHIC EXTENT

Urban Heat Island priority areas were determined through analysis of impermeable surfaces and solar radiation in the Northwest Industrial District and beyond. This maps shows that urban heat island impacts are particularly strong in industrial sites within the Northwest Industrial District. Interventions to break up the urban heat island in the Northwest Industrial District may have a positive impact on the area’s larger urban heat island.

CONNECTION TO INDUSTRY

Impacts of urban heat island did not raise as much concern for business owners and managers and technical advisors. One reason for this is because urban heat island impacts are felt on the hottest days of the year, not throughout the year. Children and the elderly are most impacted by urban heat islands, but these populations are not prevalent in District as residents or employees.

The number of particularly hot days and periods of sustained heat are predicted to increase over time with climate change. Thus, addressing urban heat island impacts may become a higher priority in years to come.

Similar to air quality issues, Good Neighbor Agreements could be used to address heat-load by understanding and adjusting timing of industrial operations.

Tree canopy expansion is an important way to mitigate urban heat island impacts. However, compatibility of tree height, bulk and species with industrial land uses and freight movement should be considered as initiatives to expand tree canopy are pursued in the area.

It was noted by a technical advisor for this project that, when irrigated, eco-roofs further help moderate urban heat island impacts during the hottest days.

MAP 3. Priority Areas to Address Impacts of Urban Heat Island

Data used: Urban Heat Island (refer to Appendix 6. NID

Sources: Multi-Resolution Land Characteristic Consortium, 2011, City of Portland
Stormwater Quality

Soil and plants absorb rainwater in natural environments. In an urban environment, streets, buildings and parking lots act as impermeable barriers to rainwater infiltration. Water washes over these hard surfaces, transporting dirt, oil and other pollutants to rivers and streams. Pollutants originating in urban areas contribute to erosion and flooding that harm properties and wildlife habitat⁹.

The Northwest Industrial District is served by storm systems that are owned by private and public parties. Many industrial activities require industrial stormwater permits to minimize the impacts of their discharge. Green infrastructure can be used with traditional approaches to manage stormwater, protect water quality and improve watershed health⁹.

GEOGRAPHIC EXTENT

This map shows priority areas, as identified by the City of Portland BES, to address stormwater runoff in terms of volume and quality. Notably, these priority areas reflect BES priorities related to the municipal storm systems which only drain portions of the Northwest Industrial District. Other areas within the Northwest Industrial District may be priorities from a broader perspective. Areas within the Northwest Industrial District that border Forest Park are considered priorities. Interventions to address stormwater quality within the Northwest Industrial District should focus here.

CONNECTION TO INDUSTRY

Most existing green infrastructure in the Northwest Industrial District was constructed per City of Portland stormwater redevelopment standards. Industrial stormwater permits are required for many industrial sites. Green infrastructure to sustainably manage stormwater can be used to meet permitting requirements under certain circumstances. Green infrastructure facilities including ecoroofs, green streets, green parking, and infiltration cells can be adapted for compatibility with industrial sites and freight streets. Examples of green infrastructure adapted to industrial areas exist throughout the Portland region.

During interviews with businesses, we heard that a few firms organize volunteer work parties for their employees to help with invasive species removal and trail improvements in Forest Park and the West Multnomah Soil and Water Conservation District. This demonstrates firm and employee interest in environmental improvements.
Habitat Connectivity

Habitat connectivity is the degree to which a landscape facilitates animal movement and other ecological flows. Urban areas, busy roads and other built features can create barriers to the movement of animals large and small, terrestrial and aquatic. Mobility is key to survival for many animal species. Poor habitat connectivity may affect migration patterns, movement of animals in search of food and protective cover, gene flow and maintaining reproduction of future healthy populations. Inadequate provision of wildlife habitat or crossings throughout urban areas may ultimately change migration patterns and contribute to population decline.

**GEOGRAPHIC EXTENT**

Forest Park and the Willamette River corridor are high priority habitat areas, suggesting that stewardship of these resources is the top priority in terms of habitat preservation and restoration. Restoration actions along the Northwest Industrial District shoreline are also noted priorities, many of which are under EPA or DEQ cleanup authority. Doane Creek Lake remnants and surrounding natural areas comprise the relatively large priority area in the northern reach of the Northwest Industrial District.

**CONNECTION TO INDUSTRY**

Habitat connectivity is not as well recognized by business owners and managers as a local environmental issue or priority to address. Several business leaders and technical advisors noted that habitat and industrial land uses can be incompatible. Contamination and other hazards on industrial sites can threaten the health of wildlife.

Certain underutilized, vacant or undeveloped sites already provide habitat connectivity for wildlife unless fenced or otherwise well-contained. Prudent determination of where in the Northwest Industrial District to emphasize improvements for habitat connectivity.

The Westside Wildlife Corridor is “the forested spine of the west hills”10. The Northwest Industrial District is situated adjacent to corridor, in stark contrast to this forested swath of land that enables continuous wildlife migration from Forest Park south along the west hills.
ENVIRONMENTAL PRIORITIES

GETTING GREEN TO WORK

29 JUNE 2015

1860 water bodies
1860 wetlands
Oregon White Oak habitat areas

0.5 miles

1860 water bodies
1860 wetlands
Oregon White Oak habitat areas

NATURAL HYDROLOGY + HABITAT

CONNECTION TO INDUSTRY (cont.)

Native tree species, including Oregon White Oaks, Douglas Firs, Big Leaf Maple and Black Cottonwood, provide valuable habitat for a variety of bird and other terrestrial species. Oregon White Oak habitat extends across the Westside Wildlife Corridor and throughout Portland. Prior to development, Oregon White Oaks existed in the Northwest Industrial District, but are now threatened. Expansion of tree canopy in the Northwest Industrial District, particularly with threatened species like Oregon White Oak, may be one way to increase habitat value in the area.

Streams in Forest Park are important homes for amphibians. There are isolated populations of Cutthroat Salmon, an Oregon-designated threatened species, in several of streams within Forest Park.

Many streams in the Northwest Industrial District are piped deep underground (~30ft). Piping and culverts limit connectivity of some streams to the Willamette. While daylighting and other strategies to restore natural hydrology are impractical or impossible in the Northwest Industrial District, brining attention to wildlife and natural hydrology emerged as a priority for technical advisors.

Social Dimension of the Issues

We aimed to understand the social dimensions of these environmental issues and others in the Northwest Industrial District. As discussed in prior sections, poor air quality and urban heat island affect human health in the Northwest Industrial and beyond. Working and residing populations may be disproportionately affected by these issues. Recommendations to address air quality and urban heat island emphasize the Northwest Industrial District’s southern extent where working populations concentrate. The recommendations also seek to enhance equity in terms of access to nature and community space, safe streets for bicycles and pedestrians, healthy workplace, and worker satisfaction.

Land and water contamination from historic industry have had far-reaching impacts on communities across the Portland region. Vulnerable populations, including tribal populations and populations of color are disproportionately impacted. Community-based organizations, including the Portland Harbor Community Coalition and its advocates, are voices for these populations. We interviewed several representatives from these organizations to understand how recommendations we may offer could synergize with their goals. These organizations emphasized contracting with community based organizations and local enterprises to carry out environmental work, particularly organizations or enterprises that provide opportunities to people, including youth, from ethnic and racial background groups.

Data used: Orthophoto, DEM, 1860 waterbodies
Sources: Metro RLIS, USGS National Elevation Dataset, TAHPDX Historic GIS Data, and the City of Portland
The joint priority map at left identifies priority zones for addressing each environmental issue described in preceding sections. These zones form the basis for siting green infrastructure strategies and other place-based recommendations.
CHAPTER REFERENCES


3. Ibid


12. Ibid
This chapter explores the feasibility of implementing green infrastructure by uncovering constraints and opportunities. Ideally, green infrastructure solutions to address environmental problems would be widely supported and easily implementable. In reality, conditions of the built and social environments constrain opportunities for project implementation. These constraints were identified through interviews with technical advisors and businesses and site visits, and through exploration of the available spatial data. This process also uncovered opportunities to aid green infrastructure implementation by building off of existing interest and investment. Opportunities, constraints and potential implications for implementing green infrastructure in the Northwest Industrial District are explored in this chapter.
Assessing of Business Interest in Green Infrastructure

Support of private property owners is needed since most land in the Northwest Industrial District is privately held and built-out. Regulatory actions are often resisted by businesses. Voluntary approaches to implementing green infrastructure and other remedies can encourage businesses to be responsive to environmental issues—often resulting in more timely implementation, with less business push-back, than through regulation alone.

In an effort to understand factors affecting business support for green infrastructure on industrial sites, we sought information on the following: concern about local environmental issues, interest in different types of green infrastructure solutions, support for green infrastructure on their sites and on public lands, and additional information or assistance needed for owners or managers to make decisions about constructing green infrastructure.

We interviewed and surveyed site owners and managers in the Northwest Industrial District to understand their specific concerns around and interest in green infrastructure investments. We conducted eight in-depth interviews and surveyed thirty-six businesses. Interviews were an opportunity to hear from business owners and managers about green infrastructure projects on their sites, about concerns specific to their sites or operations, and about how they make decisions about investment in green infrastructure. The surveys asked less detailed questions about business owners’ and managers’ concerns about environmental issues affecting the Northwest Industrial District and interest in various potential improvements in the area. Surveys were administered and collected by canvassing businesses in and near the Northwest Industrial District.

We held an open house to substantiate what we heard in interviews and surveys. The open house was attended by employees and residents of the Northwest Industrial District, as well as by other interested parties. Open house participants provided feedback on priority environmental concerns and desired improvements. Interviews with PSU faculty about their academic work on business interest in environmental issues and green infrastructure supplemented what we heard in the interviews, surveys, and the open house. Draft recommendations were presented at the NINA annual meeting and attendees weighed in on priority strategies for implementation.

FINDINGS

Key findings and information gleaned from interviews, surveys and outreach events are described below.

Interview findings represent common themes heard throughout business interviews.

Working with the City can feel difficult. Codes and regulations may discourage voluntary environmental improvements. For example, if a business voluntarily plants a new tree but later needs to remove it to expand facilities, they may be fined for removing habitat. Some businesses feel that even when they think they are working collaboratively, the City can be capricious and decide to do something else entirely.

Understanding the cost-benefit of green infrastructure is important. We did not hear ideological opposition to green infrastructure, but cost plays a large role in the willingness to make voluntary changes when budgets are tight and project are not critical for business operations. Programs that reduce the construction and maintenance costs of green infrastructure make environmental solutions more attractive.

Green infrastructure solutions are not as well understood as traditional construction methods. For example, it is easy to find a contractor to construct a traditional drainage and sewer systems. However, businesses often do not know where to begin with engineered facilities to manage stormwater on site through permeable surfaces and plantings.

Maintenance of green infrastructure is undesirable. Once a facility is constructed or installed, businesses do not want to spend much time or energy maintaining or monitoring it.

Recreational running and biking are popular activities in the area, particularly during evenings and on weekends. Few highway crossings make connections to Forest Park and other points from north of U.S. Highway 30 difficult. Abandoned railroad tracks throughout the area add character, but are hazards to pedestrians and cyclists.

The key findings below represent responses from business owners, managers and others surveyed through canvassing. Notably, two-thirds of survey respondents have decision-making ability or influence regarding infrastructure investments on their sites.

Many business owners and managers lack familiarity with green infrastructure (72%). When asked about concerns, biking safety, air quality, and land contamination were the most frequent high concerns.

When asked about desired improvements, cleanup of contaminated sites, pedestrian and bike safety, improved stormwater management, and transit accessibility are top priorities in the Northwest Industrial District.

More information about the cost-benefit of green infrastructure, employee health impacts, grants or cost-sharing partnerships, and examples of green infrastructure projects in the area would help firms to make informed decisions regarding green infrastructure and other remedies.
Transportation-Related Considerations

As an Industrial Sanctuary, the Northwest Industrial District’s transportation system prioritizes freight movement. The entire area is classified as a Freight District in the City’s Transportation System Plan, which means all streets in the area should provide truck access and circulation unless a higher street classification applies. Front Avenue, Yeon Avenue, NICOLAI Street, St. Helens Road, and U.S. Highway 30 are identified in the TSP as Regional Truckways or Truck Priority streets. Maintaining truck access and circulation is important to protect and intensify industrial land uses within Portland; however, the Freight Master Plan calls for balancing the need to maintain truck movement with needs of other modes, and considering community impacts. Opportunities exist to decrease stormwater runoff as well as increase bicycle and pedestrian circulation and access while maintaining freight movements.

We sought to understand street design characteristics that enable freight to move safely and efficiently through the area and desired pedestrian, bicycle, and green infrastructure investments that may impact freight movements. We examined Portland’s Freight Master Plan and interviewed the Freight Modal Coordinator. We also gained insight into working with businesses to build support for on-street improvements by interviewing, BES Community Relations Specialist.

FINDINGS

American Association of State Highway and Transportation Officials (AASHTO) classifies trucks by their height, width, and length. Freight District streets should accommodate the largest of truck classifications, the WB-67 which is 73.5 feet long and 9.5 feet wide inclusive of side mirrors. The minimum turn radius for a WB-67 is 45 inches and the preferred minimum lane width is 12 feet, although 11 feet lanes are acceptable in tight conditions.

The Northwest Industrial District is covered by railroad tracks that are referred to as the Guild’s Lake Trackage. The tracks are owned jointly by the Union Pacific and BNSF railroads, who provide switching services for the area. Additional trackage previously existed in the area, including trackage on NICOLAI Street. Over the last 30 years trackage was removed as firms who used the tracks dissolved or relocated. As of 2011, one regular shipper and a few occasional shippers existed in the area. BNSF is looking to eventually remove itself from their ownership.

We were unable to determine ownership of some tracks, particularly in areas where tracks are owned by a number of businesses and railroad companies. Further, making changes to areas with tracks requires collaboration on a very complex issue. While not necessarily opposed to the greening of their rights-of-way, railroad companies are concerned about liability connected to walking or bicycling near or on their properties.
FINDINGS (cont.)

Designing to accommodate multiple modes operating alongside heavy truck traffic requires case-by-case consideration, particularly in the Northwest Industrial District where older streets are narrow and constrained by established land uses. Generally, streets in a Freight District should serve trucks first, except where high demand for bicycle and pedestrian access exists, as on a transit route.

Separation of bicyclists and motor vehicles is preferred in areas with large volumes of truck traffic and/or bicyclists. In these areas, bicyclists should not share a lane with motor vehicles, and should instead have separated on-street facilities, such as bike lanes or cycletracks.

Separated on-street facilities both help and hinder truck traffic. The presence of curb-side bike facilities (and parking lanes) can reduce the required turning radii, but they can also create potential conflicts between through-travelling cyclists with right-turning trucks that often have limited visibility to their sides. The “right hook” is one of the most common for cyclists and accounts for 34% of bicycle-motor vehicle crashes in Portland\(^4\). Care should be used in designing bike facilities on streets with large volumes of right-turning trucks.

WB-67 trucks require large turning radii which increase pedestrian crossing distances. Where roads are wide, pedestrian crossings should have longer crossing times and/or a median to break up the crossing. Center medians divide pedestrian crossings into two phases which can conflict with trucks’ ability to make wide turns\(^5\).
TRANSPORTATION CONSIDERATIONS

BICYCLE + PEDESTRIAN SAFETY

FINDINGS (cont.)

Business interviews and surveys indicate walking and biking safety improvements are priorities in the area. We heard more about walking and biking for recreation than for transportation. People enjoy walking or running on lunch breaks and after work, including to Forest Park, from their job sites. On the weekends, bicyclists drive and park in the area for recreational biking in Forest Park and on Sauvie Island.

Those interviewed and surveyed identified the following safety concerns:

- Railroad tracks are hazards for both cyclists and pedestrians.
- The sidewalk network is not complete.
- Walking and biking along and crossing U.S. Highway 30 is uncomfortable.
- Road debris results in many flats for bicyclists. U.S. Highway 30 is dubbed “The Dirty 30” by some cyclists because of the bike lane’s unswept condition.

Early outreach to businesses regarding changes to streetscapes adjacent to their sites is important, as businesses appreciate predictability. Early engagement enables businesses to weigh-in on minimizing business impacts in the construction phase and beyond.

POTENTIAL IMPLICATIONS

Desire to improve walking and biking in the area exists, but freight movement must be maintained. Further study is needed to determine priority areas for walking and biking improvements. Early involvement of business and property owners, employees, and residents is key to design and construction of future facilities.

Existing Interest + Investments in Green Infrastructure

We sought to understand what green infrastructure currently exists and is planned for construction in the Northwest Industrial District. We were interested in knowing why certain green infrastructure projects were undertaken and not others. We were also curious as to how future efforts may build upon existing interest and investment.

Existing and planned green infrastructure were identified via interviews with firm owners and operators, site reconnaissance, and publicly available data and information. Green street targets were provided by City of Portland BES in support of this project. In spring 2015, a graduate level accounting course worked with MFGreen and BES on cost-benefit analyses of two green street candidates. These reports are available via the PSU library website.

FINDINGS

The map on the following page shows existing known green infrastructure facilities, including ecoroofs, stormwater facilities, and candidate green streets. Relative to other areas within the Central City, the Northwest Industrial District has relatively little green infrastructure.

Green infrastructure has been implemented on private sites in the Northwest Industrial District for various reasons, including to meet requirements related to habitat value and stormwater quality. For instance, developing and upgrading sites triggers Stormwater Management Manual requirements to construct certain green infrastructure facilities. In these cases constructing green infrastructure was not voluntary, several local business leaders engaged during this project noted the utility and benefit of green infrastructure facilities.

Often, the existence and value of green infrastructure facilities are not well communicated to firm employees or the public. Because information related to existing facilities is not well-publicized, highly visible or readily available, awareness about green infrastructure facilities and their benefits may be lacking, as our survey and interview work reveal.

Those surveyed indicate that local examples would be useful in making decisions about green infrastructure on their sites. This finding indicates that raising the profiles of local champions, like Owens-Corning and Dealers Supply Company, and increasing green infrastructure visibility may encourage other local firms to take up voluntary actions over time.
BES uses green streets to sustainably manage stormwater throughout the City of Portland, and has identified three target sites in the Northwest Industrial District:

1. **NW Front Street** - design of green infrastructure facilities on NW Front Street in the Northwest District to the south has already begun.

2. **NW St. Helens Road**

3. **NW 35th Avenue** - some green street facilities exist at the northern extent of NW 35th Avenue.

Planning and design of the SE Clay green street incorporated extensive, long-term community involvement, and special consideration for industrial land uses and freight movement are needed.

**POTENTIAL IMPLICATIONS**

Activity and interest around green infrastructure exists, and can be capitalized on. Raising the profile of local champions provides examples of green infrastructure to industrial users in the area and may encourage them to partner with local firms that already have experience with green infrastructure facilities.

Existing green infrastructure facilities, like ecoroofs and green street facilities, are opportunities of sorts from which recommendations offered by this plan build. For instance, expanding ecoroof coverage in strategic locations that synergize with existing ecoroofs could create a habitat “stepping stone” effect. Installing green streets where users are already familiar with the facilities, e.g., on NW 35th Ave and NW Front Street, may enhance their acceptance by local users and speed their implementation.

Employees are important consumers of their firms’ environmental reports according to a technical advisor interviewed for this project. Encouraging and engaging employees as green infrastructure is implemented may enhance their acceptance and uncover opportunities to capitalize on their interests.
Considerations for Tree Canopy Expansion

Trees provide numerous benefits in the urban environment. They supply food and habitat for wildlife, purify air, abate noise, supply shade, increase privacy and aesthetics, cool air temperatures, intercept stormwater and reduce runoff. The Northwest Industrial District, as well as other industrial districts in Portland, stand out for their relatively low percentage of canopy cover. Relatively few trees exist in the Northwest Industrial District today primarily for reasons related to development of industrial sites with industrial land use compatibility.

Considerations about tree canopy expansion in the Northwest Industrial District originated from interviews with technical advisors during the course of this project.

FINDINGS

Initiatives to expand the tree canopy - The City of Portland promotes expansion of the urban tree canopy through a variety of approaches including the Tree Code and Portland Trees’ Programs. Tree advocacy organizations, namely Friends of Trees, also play important roles in expanding the city’s urban tree canopy.

Trees and freight - Street trees exist in a number of locations throughout the Northwest Industrial District in varying degrees of health. Tree health issues are likely due to damage from freight traffic and inadequate maintenance. Trees are not expressly addressed in the TSP or Freight Master Plan. Best practices indicate that trees with small footprints are preferred for freight streets.

Compatibility with industrial land uses - Certain trees produce emissions that when mixed with certain other pollutants like diesel, create byproducts that can further degrade air quality and can be harmful to human health. Prudent selection of compatible tree species in terms of emissions is particularly relevant in the Northwest Industrial District, a hot spot of poor regional air quality.
**Areas designed as semi-nature**

**Known street trees**

**Street trees identified during project**

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### Tree Canopy Considerations

- **Trees for habitat** - Trees are important green infrastructure elements to enhance wildlife connectivity for terrestrial species, including insects and migratory birds. Tree canopy islands enable their movement throughout urban environments. Because not all trees have the same value in terms of habitat for wildlife, planting tree species that appeal to a wide-range of animal species may optimize potential habitat value.

- **Trees to mitigate air quality issues** - Tall trees may act as barriers that could help minimize air quality related problems. Interviews with technical advisors indicate that more information is needed about the benefit of trees to curtail certain industrial emissions and diesel; however planting tall trees near known emissions sources, like U.S. Highway 30 and industrial facilities, creates a barrier to contain emissions at their source to an extent.

- **Trees for shade** - Trees provide shade which helps address impacts of urban heat island, by breaking up impermeable surface area, shading building surfaces, deflecting solar radiation and releasing moisture into the atmosphere. Shade produced by trees can help reduce heating and cooling loads of certain buildings, particularly poorly insulated structures. Buildings with certain characteristics may require less energy for heating and cooling when tree canopies are in place. More information is needed to determine if and how structures in the Northwest Industrial District may benefit from shade trees.

- **Trees to intercept stormwater** - Trees intercept stormwater with their leaves and branches, helping to reduce and slow stormwater.

- **Trees for aesthetic value** - Trees improve streetscapes and can increase property values. It was noted in engagement with the business community that more trees are desirable for aesthetics reasons.

### Potential Implications

Different tree species are desirable for different purposes and to address specific environmental issues. Recommendations related to tree canopy expansion are specific to environmental priority areas and build on findings related to compatibility with industrial land uses. Significant resources and expertise exist in Portland to assist with expanding tree canopy in the Northwest Industrial District. Care should be taken to select tree species that fit their surroundings given site-specific considerations.

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**Map 1: Existing Trees in the NWID**

Data used: Street Tree, Vegetation, Street, River, NWID

Sources: City of Portland BES, the City of Portland, Metro RLS
Considerations Related to Cleanup of Contaminated Sites

Brownfields are defined as real property for which expansion, redevelopment, or reuse may be complicated by the presence or potential presence of hazardous substances, pollutants, or contaminants. Examples include former dry cleaners, gas stations, and metal plating sites. They may be large or small, and contamination may be readily apparent or detectable only through detailed environmental assessment. A number of sites with potential or known contamination exist throughout the district, some of which fall under Oregon DEQ or EPA’s cleanup programs.

Information about Portland brownfields and redevelopment opportunities was obtained through interviews with Portland Brownfields Program staff and local non-profit organizations, as well as supplemental research. Surveys and interviews with businesses indicate that land contamination is a concern and cleanup of contaminated sites is a priority. Mapped data indicate in DEQ’s cleanup program that are located in the Northwest Industrial District.

FINDINGS

Below are findings related to cleanup of contaminated sites in the Northwest Industrial District. Business owners and managers in the Northwest Industrial District consistently rank cleanup of contaminated land as a top priority in the area.

Contaminated sites in the Northwest Industrial District are owned by different public and private parties. Both public and private owners experience considerable financial and technical barriers to site remediation. Site contamination may limit potential future land uses and redevelopment opportunities. Many contaminated sites that previously contributed to economic vitality and local jobs now sit vacant or underutilized, awaiting cleanup.

Brownfield redevelopment programs exist at the National, State and City levels. The goal of many such programs is to reuse brownfields for economic development purposes. Funding to transform suitable brownfields into community spaces is also available.

Preservation of industrial land is important to maintenance of our region’s robust economic base. Industrial land is at a premium; thus, redevelopment of such sites for community benefit may be a tough sell. Further, redevelopment for industrial reuse can be difficult to pencil-out financially.
**FINDINGS** (cont.)

**Assessment, cleanup, liability and timeline can make brownfield redevelopment expensive and complex.** A variety of external funding and technical resources exist for brownfield redevelopment and may be available for public and private owners. Many of these awards are small and multiple awards must be cobbled together, which is time and resource consuming.

**Despite considerable constraints related to contamination and its cleanup, suitable brownfields and other contaminated sites may present opportunities for conversion into green community spaces.** Several examples exist throughout Portland, including Cully Park and Dharma Rain Zen Center. Partnership with organizations like Groundwork Portland, a local non-profit organization comprised of youth from disadvantaged backgrounds, aims to facilitate reuse of brownfields for community benefit.

**The Portland Brownfield Program is a resource for property owners, developers, community organizations and neighbors who are interested in cleaning up brownfields and recovering neighborhood land.** The Portland Brownfield Program provides financial and technical assistance with Environmental Site Assessment and development of cleanup plans. The Program was initiated in 1998 in response to an EPA environmental justice initiative. The Program depends on federal monies obtained through a competitive grant process. Thus available funding may vary. Although, privately held sites in the Northwest Industrial District may be eligible for funding, the Portland Brownfield Program targets sites in East Portland, as these communities are disproportionately impacted by health and economic effects of local brownfields.

**POTENTIAL IMPLICATIONS**

Redevelopment of certain brownfields into community green spaces is viable and may be supported by workers and residents of the Northwest Industrial District and community organizations. Cleanup of brownfields will likely not be supported with funds from the Portland Brownfield Program, as the Northwest Industrial District falls outside their target area. Other funding mechanisms and opportunities exist and should be explored for brownfield redevelopment in the Northwest Industrial District. Many awards are small and multiple awards are likely needed. Private property owners could use assistance by a third party to identify and apply for financial assistance for cleanup on their sites.

**Considerations for Vacant + Redevelopable Land**

We examine vacant/underdeveloped and redevelopable land in the Northwest Industrial District to understand

1. current uses of such sites,
2. the extent of lands that may be subject to green infrastructure and other site upgrades with redevelopment, and
3. which sites may be viable for community green/open space.

Site opportunities and barriers were also assessed in order to identify synergies with others considerations like habitat connectivity and business interests.

Information about opportunities and constraints related to vacant and redevelopable land in the Northwest Industrial District was obtained through interviews with technical advisors and best practices information. A lens for preservation and efficient use of industrial land was applied. Mapped data include vacant/underdeveloped and redevelopable parcels. Redevelopable parcels for industrial, commercial/office and public use are identified.

**FINDINGS**

Much of the remaining vacant land in the Northwest Industrial District is considered “semi-nature” and has existing contamination. Slowly being retaken by nature, the tall grasses and temporary ponds surrounded by chain link and barbed wire have become habitats again for birds, deer, and other creatures that have found holes in the fences. These sites near the Doane Creek remnant enable wildlife movement between the Willamette River and Forest Park.

These vacant lands are zoned industrial; however, site owners have yet to complete the cleanup activities required for industrial reuse. These lots will likely remain “semi-nature” for the foreseeable future, and thus a connected habitat for wildlife. Existing contamination and other environmental hazards contained on these sites may pose risks for their wildlife users.

Redevelopment according to current environmental design standards is likely to increase habitat value and environmental benefits by expanding tree canopy, and constructing green infrastructure facilities. Many redevelopable, vacant parcels in the Northwest Industrial District are small and littered throughout. Redevelopment of these vacant sites seems like further loss of potential habitat areas, they contribute relatively little to habitat value and connectivity or to the overall environmental quality of the area currently.
FINDINGS (cont.)
New construction or substantial rehabilitation often trigger significant environmental design requirements per City of Portland site design standards. Redevelopment of sites in the Northwest Industrial District fall under these requirements, prompting construction of green infrastructure. In this way, redevelopment is an opportunity to expand green infrastructure on private sites across the Northwest Industrial District.

Significant design upgrades may require expenditures beyond what businesses are able to invest, therefore discouraging redevelopment. While the purposes of these requirements are well-intentioned, such as those in Portland’s Stormwater Management Manual which are federally mandated to improve the quality of discharged stormwater, they frequently come across as discouraging to business. Significant site upgrades along with other redevelopment costs may be unattractive and discourage investment by small firms with less available capital that would otherwise be attracted to small sites prime for redevelopment in the Northwest Industrial District. Several businesses interviewed for this project fear that too stringent environmental design standards could ultimately prevent economic and job growth. Depending on the City and District’s economic development goals, other incentives may be needed for certain firms to locate in this area and meet necessary design standards.

POTENTIAL IMPLICATIONS
Site upgrades through redevelopment is an effective, efficient and important way to expand green infrastructure. However, a limited number of sites exist in the Northwest Industrial District and redevelopment of these sites may be complicated by existing contamination and other site conditions. Addressing business barriers so these sites may be redeveloped and upgraded in the future, especially for industrial uses, may facilitate expansion of green infrastructure. In the meantime, many of these sites sit untouched, offering needed land and resources for habitat connectivity.
Identification of External Support for Addressing Environmental Concerns

Limited capacity, resources, and interest of business people and firms in the area mean that external support is crucial to addressing community priorities. By nature of being an industrial district with few residents and retailers, the area lacks the engaged residential and retail communities that drive environmental initiatives in Portland. Industrial areas are not always conceived of as compatible with “green” by industrial users, and few examples of retrofitting large industrial areas with green infrastructure exist. Given the lack of community interest in greening and doubt about its compatibility with industrial land uses, support for greening the Northwest Industrial District from the broader Portland community is particularly important.

We sought to identify interest in partnering with organizations like FPC for greening and research purposes. In our interviews with business leaders and technical advisors, partnership opportunities between FPC and NINA members were also assessed. Information about grants and other funding opportunities were identified through outreach and research efforts.

FINDINGS

Further engage individuals and community-based organizations with interest in supporting green infrastructure and other remedies outside the Northwest Industrial District to accomplish more work in the District.

Community-based organizations, including Depave and Better Block, may have capacity and interest in doing future projects in the Northwest Industrial District. Depave and Better Block projects both depend on and help build community.

Portland State University professors expressed interest in furthering partnerships with FPC and BES for future class projects and other student work.

Several Portland State University professors and institutes noted interest in establishing a green infrastructure living lab. The green infrastructure living lab would be used to conduct research on various topics related to green infrastructure facilities, including cost-benefit, long-term efficacy, and optimizing design in order to address local environmental issues. It was noted by several technical advisors that siting a green infrastructure lab in an area like the Northwest Industrial District may be advantageous because of existing environmental conditions.

There is work being done by key players and researchers to address green infrastructure maintenance issues and other barriers faced by business.

NINA may use Getting Green to Work to generate interest in membership and partnership on grants.

Future work should further explore the relationship between the health of industrial workers and access to nature. Willamette Partnership is currently pursuing an initiative with academic partners, Health and Nature, to better understand this relationship and quantify value.

Certain employers in the Northwest Industrial District sponsor volunteer projects for their employees that promote environmental stewardship. These volunteer opportunities are primarily focused outside of the Northwest Industrial District. Building partnerships with FPC, could promote volunteerism and environmental stewardship in Forest Park and other nearby priority areas.

Several community-based organizations with abilities to perform work, including invasive species removal, tree and vegetation plantings, and construction using natural materials to prevent soil erosion, were identified during outreach. The Urban League and Groundwork Portland are two local organizations staffed primarily by youth from racial and ethnic background groups. Contracting with such organizations exposes youth from disadvantaged backgrounds to educational opportunities in science, technology, environment and industrial career sectors.

POTENTIAL IMPLICATIONS

FPC and BES could leverage demonstrated interest from researchers, community-based organizations and individuals. Many recommendations build on interest that we heard expressed. FPC and BES should follow up with potentially interested external partners to identify next steps in developing and working towards shared goals.
CHAPTER REFERENCES


Overview of Recommendations

The below table summarizes recommendations contained in this Chapter. Recommendations are grouped into recommendation areas. The environmental issues they seek to address and suggested timeline for implementation are given.

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<td><strong>Capitalize on unique opportunities</strong></td>
<td>Follow up with private property owners on green infrastructure ideas</td>
<td>Showcase green infrastructure at the proposed Forest Park interpretation center</td>
<td>Build a green infrastructure living lab</td>
<td>Address funding-related barriers for firms with technical assistance and incentives</td>
<td>Address implementation-related barriers for firms</td>
<td>Install green streets</td>
<td>Encourage private property owners to install green roofs</td>
<td>Encourage private property owners to construct rain gardens with native soils on their sites</td>
<td>Encourage private property owners to install &quot;rain gardens in a box&quot;</td>
<td>Encourage tree canopy expansion and planting of hedge rows</td>
<td>Reduce impervious surface area</td>
<td>Encourage property owners already pursuing cleanup on their sites to take next steps</td>
<td>Improve habitat value for wildlife in opportunity areas</td>
<td>Transform opportunity sites in community amenity space</td>
<td>Improve multi-modal safety</td>
<td>Establish a Transportation Management Association</td>
<td>Reference historic hydrology and threatened species with built features</td>
<td>Facilitate good neighbor agreements for air quality and urban heat island concerns</td>
<td>Engage PSU faculty and students in research and coursework to expand on current efforts</td>
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**Air quality**, **Urban heat island**, **Stormwater**, **Habitat connectivity**, **Social benefits**

**Methodology for Determining Recommendations**

A methodology for recommending projects emerged from meeting with the Forest Park Alliance and technical advisors in February 2015:

1. Use available environmental data and information about green infrastructure to determine where siting will provide the most benefit to the health of Forest Park, the Northwest Industrial District, and the Willamette River.
2. Determine the feasibility of green infrastructure projects through outreach to the business community for by identifying factors which affect willingness and ability to implement green infrastructure projects on private and public lands.
3. Recommend projects that fall within the intersection of most beneficial for health of the environment and most feasible from the business perspective. The below graphic provides more detail about how our process informed the recommendations.

Mapped data indicate where air quality, urban heat island, stormwater quality, and habitat connectivity priorities are concentrated in the Northwest Industrial District (Chapter 2). Priority zones indicate where green infrastructure solutions are most needed.

Interviews with technical advisors and related case study and best practices research shaped how we thought about feasibility of various green infrastructure solutions in industrial settings (Chapter 3). Recommendations are filtered through our findings about factors affecting feasibility.

Business interest in implementing green infrastructure is a major constraint on feasibility because much of the land in the Northwest Industrial District is privately owned. Businesses were interviewed and surveyed about their interest in addressing local environmental issues and learning more about and implementing green infrastructure projects on their sites. Recommendations reflect business interests.

Other opportunities to support strategies and projects, such as through partnerships or policy changes, were identified in interviews with businesses and technical advisors. Selection of final recommended strategies considered their ability to (1) address local environmental priorities, (2) match interests of the business community, and (3) aid implementation by linking efforts and removing barriers.
LIMITATIONS
This methodology has served the project well; though, there are a few constraints on this framework:

- Walking and biking improvements are explicit areas of project focus, but are not traditionally considered green infrastructure. Barriers to walking and biking were not examined alongside environmental issues due to lack of data and because improvements do not directly address local environmental issues. As a result, walking and biking recommendations are derived primarily from the input of the business community and others in the Northwest Industrial District.

- Outreach to the business community resulted in identification of barriers to implementing green infrastructure, rather than in identification of ready-partners and projects. As a result, many policy, program, and partnership recommendations were identified as ways to reduce barriers to project implementation.

- The ability to recommend specific, nearly-shovel-ready projects was limited by the number of businesses the project team could engage in the project timeframe and by existing knowledge of the businesses that were engaged regarding green infrastructure. As a result, the recommended projects list includes less specific projects than originally planned. Raising the level of awareness around green infrastructure in the area will help uncover more specific projects in the future.

OVERVIEW
Implementing this Plan
Recommendations include a brief description about implementation of the recommendation. Importantly, parties involved in implementation and timeline for implementation are given.

PARTIES INVOLVED IN IMPLEMENTATION
One goal of this project is to connect Northwest Industrial District businesses with resources that will help them to implement green infrastructure projects. In many cases, recommendations benefit when other organizations and firms lead project implementation; however private land and business owners retain ultimate decision-making authority and responsibility for improvements on their sites. Recommendations utilize the following framework to help clarify involved parties. The following framework identifies parties to Lead, Support, Engage and Inform during project implementation. Assignments given in this document are suggestions and are not comprehensive.

- Leading parties have primary responsibility for implementing the recommendation. Responsibility can include project design, management, and execution. Sometimes these tasks are shared among several stakeholders.

- Supporting parties may have certain decision-making authorities affecting implementation of a project. In most cases, the supporting party will be the property owner, but sometimes implementation of a recommendation will require permission from regulatory bodies, such as ODOT for improvements along U.S. Highway 30.

- Engaged parties may include those with technical and/or local expertise, or those who will be significantly impacted by implementation of a recommendation but are not leading or supporting parties. An example of a consulted party with technical expertise is Greenroof Info Think-Tank who could offer feedback on green roof design. Adjacent property owners to green street target areas are an example of engaged parties who stand to be significantly impacted by a project.

- Informed parties should be generally made aware of a project, but they do not have significant influence over or stand to be significantly impacted by a recommendation.

TIMELINE
Recommendations are prioritized into immediate-term (1-5 years) and longer-term (5-10+ years) projects. Prioritization is based on the environmental priorities, interest from the business community, and feasibility in terms of cost or accountability.
Follow up with private property owners on green infrastructure ideas

Locations of green infrastructure projects are on private properties in the Northwest Industrial District identified during outreach.

**LEAD:** Private property owners are responsible for projects on their sites

**SUPPORT:** BES+ FPC

**ENGAGE:** Partners of BES and/or FPC who may be of assistance

**INFORM:** Public

**1 - 5 Years.** These projects are immediate-term because barriers to implementation are low and current enthusiasm for green infrastructure is relatively high. Decision-makers for these properties were engaged during this project, and they are interested in taking next steps with BES and/or FPC.

These projects should have few obstacles to implementation given they were suggested by site owners or managers as desired improvements.

These projects were identified by site owners and managers through interviews for this project.
RECOMMENDATION 2

Showcase green infrastructure at the proposed Forest Park interpretive center

The proposed Forest Park interpretive center is an opportunity to showcase green infrastructure through building and site design. Decision-makers should include the following elements in design as possible: ecroofs, permeable pavers in parking and other paved areas, appropriate green infrastructure to manage stormwater, and native trees and landscaping. In addition to providing on-site environmental benefit, showcasing green infrastructure will provide example of green infrastructure opportunities to local firms.

NW Yeon + NW Nicolai is a candidate site for the proposed interpretive center. This area is located in urban heat island and air quality priority areas and close to the stormwater priority area.

LEAD: Metro Parks, City of Portland Parks and Recreation, BES, FPC
SUPPORT: Metro Parks, City of Portland Parks and Recreation, BES, FPC
ENGAGE: Local site owners and operators
INFORM: Public

6 - 10+ Years. This is a longer-term project given that funding is not in place and plans for the Forest Park interpretive center are not yet moving forward. We recognize that the proposed Forest Park interpretive center is somewhat controversial. Question about whether the proposed site is ideal remain. Core siting considerations include access to Forest Park for North Portland and Northeast Portland residents, neighborhood impacts and cost. Additional considerations may include bike and pedestrian access and siting for greatest environmental and community benefit. The proposed site is near the NW Front Street green street target area; synergies may exist here.

The proposed Forest Park interpretive center came up in several interviews. Surveyed businesses expressed a strong desire for local examples of green infrastructure. It was noted that a green infrastructure showcase project in the Northwest Industrial District would bring attention to green infrastructure solutions in industrial settings.

RECOMMENDATION 3

Build a green infrastructure living lab

Several Portland State University professors indicated interest in establishing a green infrastructure living lab. The green infrastructure living lab would be a facility for various types of research on constructed green infrastructure, including best management practices, construction techniques, long term performance and cost-benefit. The facility could be as simple as a small outdoor facility that also serves as community open space. The facility could be sited on vacant public land or on a private site through partnership with an existing NWID firm.

To be determined. Depending on the focus of the lab, different priority zones may be preferred.

LEAD: PSU, FPC, other interested parties
SUPPORT: PSU, site owners
ENGAGE: Washington Stormwater Center
INFORM: Business community, general public

6 - 10 Years. This is a long-term project that involves many parties and adequate funding.

Opportunities may exist in terms of siting this facility in the Northwest Industrial District due to present environmental conditions.

PSU faculty expressed interest in establishing a green infrastructure living lab in interviews.
Address funding-related barriers for firms with technical assistance and incentives

Funding assistance is one barrier for business investment in green infrastructure that implementers of this plan can help address. Our outreach indicates that firms in the NWID could use assistance identifying and securing funding for green infrastructure. Consider partnering with NINA to develop resources and capacity to provide assistance to firms seeking funding. Promote existing incentive programs to firms in the NWID and look to expand or modify incentives programs to encourage industrials users.

Technical assistance and incentives should extend to firms throughout the NWID.

**LEAD:** FPC, BES

**SUPPORT:** FPC, BES, other Bureaus like BPS, PBOT, PDC, Metro

**ENGAGE:** Port of Portland

**INFORM:** NINA, Northwest Industrial District business community

**1-5 Years.** Many private property owners are interested in implementing green infrastructure on their sites, and assistance with the funding process may help them act on these interests. Providing assistance with the funding process would help address financial barriers for business. In outreach, promote existing incentive programs offered by BES and others.

**5-10 Years.** In the longer term, BES may wish to evaluate utilization of incentive programs by industrial firms and expand or modify programs based on priorities.

Incentive-based programs and assistance with identifying and securing funding for green infrastructure were among the most desired improvements for businesses interviewed and surveyed for this project. Specifically, businesses ranked cost-benefit and grants or cost sharing partnerships as topics they would like to know more about before making decisions about green infrastructure on their sites.

**RECOMMENDATION 5**

Address implementation-related barriers for firms

A number of business barriers related to implementing green infrastructure on privately held sites were uncovered during the course of this project that can be addressed by implementers of this plan. Engaged businesses were interested in assistance with the following: identifying contractors with green infrastructure expertise, working around regulatory uncertainties, using green infrastructure to meet regulatory requirements, and maintaining green infrastructure once implemented. Consider partnering with NINA to develop resources and capacity to provide assistance to interested firms.

Assistance should extend to firms throughout the NWID.

**LEAD:** FPC and/or other CBO, BES

**SUPPORT:** FPC, BES, other Bureaus like BPS, PBOT, PDC, Metro

**ENGAGE:** NINA, Northwest Industrial District business community

**1-5 Years.** FPC and/or other CBOs should employ the following strategies to help address implementation-related barriers for firms in the NWID:

1. Assist firms in finding and selecting contractors with expertise in green infrastructure by developing a directory of local engineering firms familiar with green infrastructure project planning and implementation.

2. Enhance bidirectional communication between businesses and site owners, and the City about requirements related to green infrastructure that affect their sites and voluntary options for meeting requirements, such as industrial stormwater permitting requirements.

3. Minimize maintenance responsibilities by developing shared maintenance agreements between firms with green infrastructure and CBOs or microenterprises that carry out maintenance contracts.

Strategies to address implementation-related barriers for firms were informed by business interviews and interviews with technical advisors. Specifically, businesses ranked cost-benefit and grants or cost sharing partnerships as topics they would like to know more about before making decisions about green infrastructure on their sites.
Install green streets

Install green streets in target areas. Green streets target areas are located where greatest benefit in terms of stormwater volume and quality is achieved. Green street design should involve and accommodate industrial users. Early involvement and educational outreach may help enhance acceptance of green street facilities. Pedestrian and bike amenities should be integrated into the design as possible. Whether in support of BES green street projects or not, working with organizations like Better Block on temporary installations may help NWID users envision alternative street uses.

See the map at left for green street target locations. Green street facilities are currently under construction along NW Front St. in Northwest District. Repaving and streetscaping was completed recently in northern stretch. Existing green street facilities are located along the north end of NW 35th Ave.

**LEAD:** BES

**SUPPORT:** BES

**ENGAGE:** Better Block

**INFORM:** Public, Northwest Industrial District business community

**TIME LINE**

1 - 10 Years. Green street facilities in the CEID may be regarded as higher priority for immediate implementation by BES. Moving forward on green street target areas in the NWID, however, may be better supported and logistically simpler given site considerations and parking availability than similar work in the CEID. Business community members engaged in this project ranked installation of green streets highly among projects they would like to see move forward in the next few years.

In effort to provide useful information related to green street prioritization in the NWID, MF Green, BES and FPC worked with a class of graduate accounting students to complete cost-benefit analyses which are on the PSU library website.

Information related to green street target areas was provided by BES. Over half of all respondents from the NINA meeting noted that they would like to see green streets projects initiated in the next few years.
Encourage property owners to install ecoroofs

Ecoroofs are used across Portland to manage stormwater runoff and provide other environmental benefits including energy savings, pollution and erosion reduction and habitat connectivity. Especially when irrigated, ecoroofs may also help reduce urban heat island impacts. The following are opportunities for expanding ecoroofs in the NWID.

1. Encourage ecoroofs in new development and site upgrades and for small-scale structures
2. Create patchwork of ecoroofs and habitat roofs between the Willamette and Forest Park

Recommended target areas are shown and described at left. These areas were selected because of urban heat island and stormwater priorities.

LEAD: FPC, BES, NINA
SUPPORT: Property owners and real estate developers
ENGAGE: BES, Greenroof Info Think-tank (GRiT)
INFORM: Employees on-site

1 - 10+ Years. BES already encourages private property owners to construct ecoroofs. The following points can be leveraged with industrial users to encourage ecoroof construction.

- Materials and skill sets unique to industrial firms may facilitate construction of small-scale ecoroofs with readily available materials and labor. Experience and examples already exist in the Northwest Industrial District.
- Structural integrity of many existing buildings in the Northwest Industrial District may preclude ecoroofs.
- Cost and maintenance associated with ecoroof construction for new developments and retrofits may be comparable to cost and maintenance associated with conventional roofing.

Interviews and surveys with businesses indicate interest in expanding ecoroof coverage. Ecoroofs were noted as one of the most desired improvements. Interviews with technical advisors also informed this recommendation. Further, this recommendation builds on Gunderson’s work designing and building habitat roofs on their site, and establishing their habitat value.
GREEN INFRASTRUCTURE: MODULES FOR ALL SITE CONDITIONS

RECOMMENDATION 8

Encourage private property owners to construct living walls with native soils on their sites

Encourage private property owners to construct living walls—low-cost, vegetated modules for habitat connectivity—that can be implemented on virtually any site, alongside buildings or fences for instance, on paved or unpaved surfaces. Living walls are well-suited to large paved industrial sites with sparse greenery. Gunderson has been experimenting with living walls that use native soils and plants for the last several years. Interested firms should connect with Gunderson to learn more.

Encourage property owners district-wide, but specifically target sites in or near habitat priority areas and sites where opportunities for greenery are limited.

LEAD: Site owners
SUPPORT: BES, FPC, NINA or other CBO
ENGAGE: Gunderson, LLC
INFORM: Working public

1 - 5 Years. Living walls are an immediate-term priority because of limited opportunities to improve habitat connectivity in other priority areas and to capitalize on Gunderson’s existing efforts.

Habitat walls may be constructed from reused or recycled materials, such as milk crates, that industrial users may have at their disposal. Fabrication of habitat walls could be done by the user or by a small-scale economic enterprise.

This recommendation originated from Gunderson’s work designing and building “habitat walls” on their site, and establishing their value.

RECOMMENDATION 9

Encourage private property owners to install “rain gardens in a box”

Encourage private property owners to install “rain gardens in a box”—above-ground, low-cost, portable biofiltration cells—that be implemented under downspouts on virtually any site. “Rain gardens in a box” are well-suited to industrial sites where existing land contamination may restrict sub-surface green infrastructure. The Port of Vancouver’s experimental systems (Grattix) reduced zinc pollution in stormwater from galvanized metal roofs and downspouts by 90-95%. More information and “how to” fliers are available at their website.

Encourage property owners district-wide, but specifically target sites in or near stormwater priority areas and sites where opportunities for sub-surface green infrastructure are limited.

LEAD: Site owners
SUPPORT: BES, FPC, NINA or other CBO
ENGAGE: Port of Vancouver
INFORM: Working public

1 - 5 Years. “Rain gardens in a box” are short-term prioritizes because they are inexpensive, and easily and quickly implemented.

“Rain gardens in a box” may be fabricated from common, low-cost, reused or recycled materials. Fabrication of “rain gardens in a box” could be done by the user or by a small-scale economic enterprise. The Port of Vancouver has been experimenting with these systems and may be able to provide guidance and information about their use and maintenance.

“Rain gardens in a box” were mentioned in interviews as potentially compatible solutions for managing stormwater runoff from galvanized metal roofs on industrial structures.
Encourage tree canopy expansion and planting of hedge rows throughout the Northwest Industrial District

Implementers of this plan should encourage tree canopy expansion along streets and on private properties throughout the NWID. Trees and hedges in the NWID stand to provide various benefits, including habitat connectivity for terrestrial species and pollinators, air quality improvements, shade to break up urban heat island, natural stormwater management, and enhanced aesthetics. Specific types of vegetation should be emphasized in different areas to address targeted environmental issues. Explanation of priority plantings in target areas is at left.

Initiatives to increase tree canopy and hedge rows should be district-wide with focus on the two identified target areas and generally in urban heat island, air quality and stormwater priority areas. Target private property owners in target area 1. Prioritize freight streets with few existing trees [NW St. Helens Rd., NW Front St.] across the NWID and non-freight streets in target area 2.

1 - 5 Years. Expansion of Portland’s tree canopy is a City priority and desired improvement by businesses surveyed and interviewed during this project. The following points can be leveraged to encourage property owners to increase tree canopy and hedge rows.

- Businesses may have reservations about planting trees on their properties because of maintenance responsibilities and uncertainty about potential liability and repercussions associated with tree removal.
- Maintenance-related issues may limit expansion of street tree canopy.
- Information related to efficacy of tall tree barrier approaches as mitigating air pollution is lacking. Connecting with interested PSU faculty may yield fruitful research and best practices.

Businesses surveyed and interviewed during this project expressed desire to expand tree canopy and plant hedge rows in the NWID, both on private sites and on streets. Information about implementing tree and hedge projects emerged from interviews with technical advisors.
**SITE TRANSFORMATION: MINIMIZE IMPERMEABLE SURFACES**

### RECOMMENDATION 11

**Reduce impermeable surface area in the Northwest Industrial District**

Encourage efforts to reduce impermeable surface area in the NWID to address urban heat island impacts and stormwater priorities. The following opportunities exist:

1. Encourage private property owners to use permeable concrete or pavers for parking areas and driveways in new construction or upgrades. Although freight traffic can wear permeable concrete or pavers more quickly than traditional materials, permeable concrete and pavers are well-suited to industrial parking lots where freight use is less intensive.

2. Certain underutilized or unnecessary paved areas in the NWID could be depaved and transformed into open community space. Candidate sites may be publicly or privately held.

Permeable paving should be encouraged across the NWID with emphasis on sites within urban heat island and stormwater priority areas. Preferred sites for depaving and transformation into community open space will be located in the southern extent where employee populations are most dense.

**LEAD:** Site owners, NINA, FPC, CBOs like Depave

**SUPPORT:** Site owners

**ENGAGE:** Depave

**INFORM:** Public, working public

1 - 10 Years. Outreach to industrial users about permeable pavers can begin immediately.

A project with Depave could be pursued in the immediate-term also. Projects generally take one year to complete depending on project complexity; brownfield sites will likely be ineligible.

Partnership with organizations like Depave requires extensive community support and involvement. Because workers leave the district, drumming up the community support needed may present a challenge. Volunteer channels with local firms could help supply the community workforce needed.

This recommendation originated from best practices information, and was informed by interviews with CBOs, including Depave.

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### RECOMMENDATION 12

**Encourage property owners already pursuing cleanup on their sites to take next steps**

Encourage halted property owners and those with sunk investments to take next steps in their cleanup activities. For instance, one site owner (Brazil Motors) initiated a brownfield remediation process with funding from the BES Brownfields Program. To-date, an Environmental Site Assessment is complete; however, cleanup activities have not been initiated due to the legal and logistical complexity of cleanup. Implementers of this plan should connect with this owner and potentially others who have already taken steps to address contamination on their sites. Effort should be made to address their barriers to taking next actions.

Engage potentially affected site owners across the NWID.

**LEAD:** Site owners

**SUPPORT:** BES, FPC

**ENGAGE:**

**INFORM:**

1 - 10 Years. Outreach to affected site owners can begin immediately. Cleanup timeline will depend on complexity of the cleanup and motivation of site owners or managers. Cleanup of contaminated sites ranked among the most desired improvements by businesses engaged in this project.

The legal context of potentially responsible parties may significantly derail moving forward with cleanups, such as that on the Brazil Motors site.

This recommendation emerged from interviews with technical advisors. It is informed by outreach to the business community during the course of this project.
**RECOMMENDATION 13**

**Improve wildlife habitat value in opportunity areas**

Follow up with site owners on or near habitat priority areas to discuss next steps in initiating restoration work to improve habitat value and connectivity, prevent soil erosion and remove invasive plant species. The Doane Creek remnant is a particularly significant wildlife corridor for movement between Forest Park and the Willamette River and should be a focus of these and other efforts to improve habitat connectivity. Further, candidate sites should be prioritized since restoration work is not practicable in other priority habitat areas.

Sites near the Doane Creek remnant and along the Willamette River, where existing land contamination is not prohibitory, are good candidates. Target areas are described at left.

**LEAD:** Site owners  
**SUPPORT:** Site owners  
**ENGAGE:** Gunderson, LLC  
**INFORM:** Public, working public

**1 - 5 Years.** Improving habitat value where currently possible on the riverfront and near the Doane Creek remnant is an immediate-term priority because (1) many habitat priority areas are associated with CERCLA, and (2) to capitalize on Gunderson’s interest and momentum for doing this type of voluntary work. Restoration activities are complex, expensive and time-consuming, particularly when complicated by proximity to heavily contaminated sites. Depending on the extent of contamination and the available cleanup technologies, leaving certain sites untouched temporarily may be advantageous.

This recommendation was informed by interviews with technical advisors and BES program staff. Interviewed and surveyed businesses consistently ranked cleanup of contaminated sites as priorities they would like to see moved on in the next few years. Businesses also stated a preference for addressing habitat connectivity in natural areas and wildlife corridor areas rather than on built-out industrial sites where hazards may be present.
Transform opportunity sites into community open space

Take next steps with site owners to transform opportunity sites into needed community open space. The following opportunities exist:

1. Brownfields with significant redevelopment costs that are undesirable for industrial reuse may be ideal candidates for siting community open space and making efficient use of land in the NWID.

2. Promote utilization of unimproved rights-of-way for pedestrian connections and community open space. City-owned ROWs might be usable for open space such as "pocket places" and community gardens if encroachment permits are granted by PBOT.

Preferred sites will be located in the southern extent of the NWID where employee populations are most dense.

LEAD: Property owners, FPC, other CBOs
SUPPORT: Property owners
ENGAGE: DEQ, BES, other City Bureaus, Groundwork Portland, area employees
INFORM: NINA, public, working public

1 - 10 Years. Next steps for community-supported projects should be pursued in the immediate terms; however, project complexity will dictate project timeline. It may be difficult to drum up support for projects that require extensive community support and involvement. The following regulations are relevant:

- ORS 193.476 precludes predatory sex offenders from places where minors could congregate which includes parks. Be careful not to define community use of ROWs as parks.
- ORS 105.682 limits liabilities for land owners who wish to use their properties for recreational purposes as long as they do not charge for use. Follow up with Dealers Supply Company who has proposed their back lot for development into community open space (see Recommendation 1) if they can 1) retain right to develop the land in the future as the business expands, and 2) can keep the public off operational areas of the lot.

Interviews, land use data, and site visits revealed inadequate supply of open space for employees. Need for outdoor spaces for workers to eat lunch were noted. Desire to address site contamination while providing community benefit was expressed by business engaged in this project and technical advisors.
RECOMMENDATION 15

Improve multi-modal safety in the Northwest Industrial District

The following strategies should be pursued to enhance bicycle and pedestrian safety:

1. Identify pedestrian routes and opportunities for new connections from points north of Highway 30 to Forest Park, and advocate for safety and connectivity improvements. In some cases, pedestrian routes may exist but the right-of-ways is unclear.

2. Remove decommissioned railroad tracks running within travel lanes or crossing roads at angles less than 45-degrees. While decommissioned tracks add character to the industrial district, they also create hazards for cyclists when crossed at small angles because the gap between the track and pavement “catches” bike tires.

Enhancements for pedestrian and bicycle safety should be assessed district-wide. Several opportunities identified during the course of this project are outlined below.

LEAD: FPC
SUPPORT: PBOT, ODOT, site owners when necessitated
ENGAGE: Pedestrian advocacy groups like Oregon Walks, residents, employees
INFORM: NINA, adjacent property owners

1 - 5 Years. Identify priority bicycle and pedestrian areas, and clarify ROW. The following specific actions are suggested:

1. Clarify ROW, NW 30th Avenue between MacLay Park + NW Nicolai St
2. Explore pedestrian easements, NW Yeon Ave, NW Nicolai St + NW 29th Ave
3. Explore connectivity/ROW clarification between NW St Helens Rd, NW Thurman St + FP
4. Confirm whether the following are decommissioned and suitable for removal: (1) NW Industrial St. + NW 30th Ave; (2) NW Yeon Ave at NW Industrial St.; (3) NW 35th Ave at NW Industrial St.; (4) NW Nela St.

6 - 10+ Years. Implementation of capital projects such as sidewalk construction and decommissioned railroad track removal or modification.

Interviews identified walking as a popular activity, concern for walking safety, and frustration at low connectivity. Pedestrian safety improvements emerged as a priority for businesses through outreach.

RECOMMENDATION 16

Establish a Transportation Management Association for the Northwest Industrial District

Establish a Transportation Management Association to encourage employees to walk, bike, transit, or carpool to work. The TMA may also serve as an effective advocate for transportation improvements in the area.

A TMA would work at the district level.

LEAD: NINA
SUPPORT: NINA
ENGAGE: Swan Island TMA
INFORM: Area businesses + employees

1 - 5 Years. Addressing transportation-related issues is a priority for other business districts in Portland. A TMA seemed like a good fit for NINA who seeks to expand their membership.

The Swan Island TMA is a project of the Swan Island Business Association. NINA, as a neighborhood association in a primarily business district, could operate a TMA in a similar way. Operating a TMA could be a way to generate interest and membership in NINA.

Interviews identified walking and biking as popular activities, and concern for walking and biking safety. Walking and biking safety improvements emerged as a priority for businesses through outreach.
Reference historic hydrology and threatened species with built features

Referencing historic hydrology and threatened species is one way to educate the public about local environmental concerns and celebrate historic site conditions. A variety of potential strategies exist, including signage, naming of public spaces, public art installations and other designed features. Some specific things to bring attention to include the isolated cutthroat trout population, Oregon White Oak habitat, historic waterways that run through the area (e.g., Alder Creek, Thurman Creek, Yeon Creek).

Opportunities for educational features and references should be explored district-wide.

**LEAD:** FPC, BES, other City Bureaus  
**SUPPORT:** FPC  
**ENGAGE:** BES  
**INFORM:** Public

**1 - 10 Years.** This recommendation can be acted on immediately, and promoted alongside other recommendations as they move forward over the next 10 years.

Several examples of education features and references exist in Portland. Inspiration for the recommendation Tanner Springs Park in NW Portland serves as precedence for this recommendation.

Referencing historic features or would-be features of the area emerged from interviews with technical advisors and City program staff.

Facilitate good neighbor agreements for air quality and urban heat island concerns

Good Neighbor Agreements are written documents that contain terms agreed upon by two or more parties, usually between neighbors and businesses, that address concerns and potential issues that may arise. GNAs have been used at least once in Portland to facilitate pollution and odor reduction at an industrial facility (ESCO in NWID). Although establishing and maintaining GNAs can be time-consuming and expensive, they show promise in addressing emissions-related problems that drive air quality and urban heat island issues.

Firms overrepresented in emissions contributions should be targeted. Preferred sites will be located in the southern extent where impacts of poor air quality and urban heat island are greatest.

**LEAD:** FPC, CBOs like Neighbors for Clean Air  
**SUPPORT:** Targeted firms + their neighbors  
**ENGAGE:** Neighbors for Clean Air, ESCO  
**INFORM:** NINA, public, working public

**1 - 10+ Years.** This recommendation should be prioritized, as source reduction is an important way to address air quality and urban heat island impacts. Negotiation and implementation of GNAs may take many years, so first steps can be taken now.

GNAs can be complex, requiring legal representation for neighbors and firms and potentially years of negotiation. Implementation of GNAs requires ongoing community support and business motivation. Neighbors for Clean Air, an FPA member organization, has experience working with industries on voluntary source reduction in Portland. Connect with Neighbors for Clean Air to determine next steps.

This recommendation originated from FPA members involved in this project, and was informed by interviews with technical advisors.
RECOMMENDATION 19
Engage PSU faculty and students in research and coursework to expand on current efforts

Involving PSU faculty and their students in class projects in the area. PSU classes frequently involve projects working with and in Portland communities, particularly the senior capstone projects. Projects could address green infrastructure implementation or other interest areas for businesses, residents, and organizations in the area.

Encourage study district-wide and further afield.

LEAD: BES, FPC, NINA
SUPPORT: FPC
ENGAGE: PSU ISS
INFORM: Area businesses + organizations

1 - 5 Years. FPC and BES have strong existing relationships with PSU. Momentum from this project and recent other projects should be capitalized on.

Below are some potential topic areas for future study:

- Connection between worker health + nature/green infrastructure (School of Community Health)
- Ecosystem service benefits (Institute for Sustainable Solutions)
- Business environmental leadership (Institute for Sustainable Solutions)
- Urban climate + building science

Interest in working in the area emerged through interviews with PSU faculty. This interest resulted in collaboration with Professor Darrell Brown’s graduate accounting class on cost-benefit analyses of green street candidates in the Northwest Industrial District.

RECOMMENDATION 20
Establish volunteer partnerships and learning opportunities in the community

Assist firms in establishing volunteer partnerships, and learning and work opportunities with CBOs and microenterprise organizations. Firms could partner with such organization to perform the following types of work: maintain green infrastructure, remove invasive plants and build modules like “rain gardens in a box”. Prioritize working with CBOs like Urban League that provide youth of color opportunities to engage with the business, industrial, academic, and environmental communities.

Encourage firms across the district to partner with these types of organizations.

LEAD: Involved businesses, CBOs like Urban League + Groundwork
SUPPORT: FPC
ENGAGE: Gunderson, Urban League, Groundwork Portland, Metro
INFORM: NINA, area businesses + employees

1 - 5 Years. This is an immediate-term priority, as it requires little to get started.

Opportunities to expand partnerships with businesses and CBOs exist. Existing partnerships identified during this project can be built upon and used as examples for new partnerships.

This recommendation was inspired by the following uncovered during this project.

- Gunderson partners with the Urban League of Portland on summer education programs for youth from racial and ethnic background groups.
- Groundwork Portland’s “Green Team” engages youth from racial and ethnic background groups in paid summer internships to address environmental justice issues.