Normal Avenue Neighborhood Plan - Infrastructure Framework

Introduction (Sustainable Approach to Infrastructure)

Green infrastructure is only feasible at the district-scale; and the development of the Normal Avenue neighborhood provides an excellent opportunity to apply sustainability strategies that may not be feasible elsewhere in the City. District-wide energy, integrated stormwater management and open space planning, habitat creation and protection, and transportation infrastructure should be systematically designed and constructed within the study area.

This memorandum will address the following issues:

- Stormwater Management,
- Water and wastewater systems,
- Protection of water resources,
- Energy, heating and cooling, and
- The Uptake and adoption of new ideas.

Stormwater Management

The focus for stormwater management in the Normal Avenue neighborhood should be on low-impact development (LID) techniques, controlling stormwater at its source. Rather than moving stormwater offsite though an engineered conveyance system, the goal of LID is to maintain the natural, ecosystem functions of infiltration and retention.

LID integrates small-scale techniques from throughout the different developments. Green spaces, native landscaping, innovative bioretention and infiltration techniques capture and manage stormwater on-site. LID reduces peak runoff by allowing rainwater to soak into the ground, evaporate into the air, or collect in storage receptacles for irrigation and other beneficial uses. The resulting site designs will more closely maintains pre-development hydrology, include greater amounts of green space, and in some cases be cheaper to build than using conventional stormwater management techniques.

Soils and Infiltration

Understanding infiltration rates and capabilities of the study area is critically important to the design of appropriate stormwater systems. The following information is derived from the USDA Natural Resources Conservation Service, Custom Soil Resource Report for Jackson County Area. The report shows that the soils in the study will generally drain very poorly. Soils are assigned to one of four groups according to the rate of infiltration of wet non-vegetated soils. Detailed assessment of soils, which can very within even small study areas, should be undertaken as part of pre-development geotechnical investigations.

The groups are defined as follows:

- Group A soils have a high infiltration rate and low runoff potential.
- Group B soils have a moderate infiltration rate.
- Group C soils have a slow infiltration rate.
- Group D soils have a very slow infiltration rate and high runoff potential). In the Normal Avenue area, these consist chiefly of clays that have a high shrink-swell potential and soils that have a claypan or clay layer at or near the surface. These soils have a very slow rate of water transmission (USDA 2012).

Hydrologic Soil Group— Summary by Map Unit — Jackson County Area, Oregon, Parts of Jackson and Klamath Counties (OR632)

Soils/ units	Rating	Acres	Percent
Central Point sandy loam, 0 to 3 percent slopes	A	2.8	13.3%
Kubli loam, 0 to 3 percent slopes	D	14.5	68.1%
Kubli loam, 3 to 7 percent slopes	D	1.9	9.0%
Shefflein loam, 7 to 20 percent slopes	C	2.0	9.6%
		21.3	100.0%

Table 1 Hydrologic Soil Group (Normal Ave Ashland, OR Soils) USDA 2012.

Low Impact Development

LID can be both simple and effective. The following approaches are generally recommended, and should be considered for either new code requirements or incentivized. The following examples are drawn from previous projects completed by Nevue Ngan and Associates and Parametrix. These techniques can be further explored at the U.S. EPA website.[1]

Figure 1. Bioretention cell

Bioretention cells commonly known as rain gardens, are relatively small-scale, landscaped depressions containing plants and a soil mixture that absorbs and filters runoff. Because of the poorly draining Class D soils, development

[1] http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=124&minmeasure=5.

within the study area should include stormwater planters. More engineered than rain gardens, stormwater planters are designed to accept stormwater from an adjacent area, are filled with soil and planted, and will infiltrate water through the ground to a pipe connected to a storm sewer, or perhaps to natural features such as the wetlands, Clay Creek or Cemetery Creek.[2]

Within developments with higher floor area ratios, flow-through planters are also recommended. Flow-through planters do not infiltrate into the ground. They are filled with gravel, soil, and vegetation and are typically waterproofed. Temporarily storing stormwater runoff on top of the soil, these will filter sediment and pollutants as water slowly infiltrates. Excess water collects in a perforated pipe at the bottom of the planter and drains to a storm sewer (City of Portland 2006).

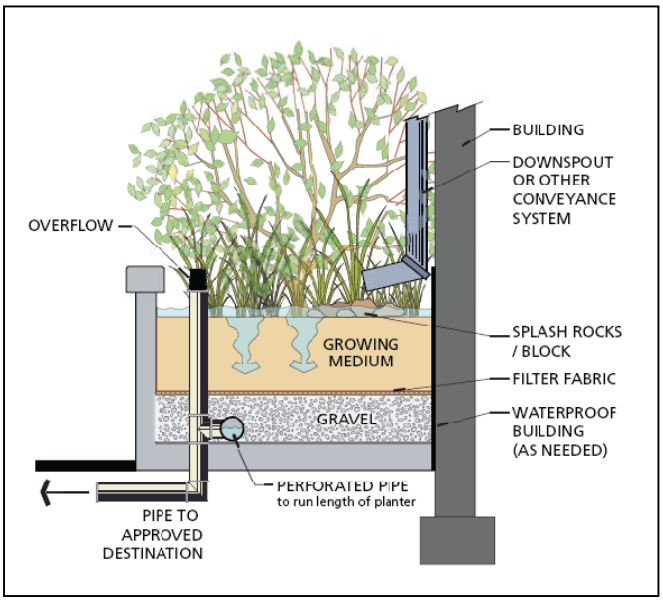

Figure 2. Flow-through planter (City of Portland 2006)

Grass swales can also be used in the design of infrastructure for the area. These have broad, open channels with erosion resistant and flood tolerant grasses, sedges, and other herbaceous plants. Alongside roadways swales slow stormwater runoff, filter it, and allow it to soak (though limitedly in this area) into the ground. Swales improve water quality and reduce in-stream erosion by slowing the velocity of stormwater runoff before it enters the stream. They also cost less to install than curbs, storm drain inlets, and piping systems (USEPA 2010).

Other techniques for minimizing run-off will be considerate for individual home builders or homeowners. These features can be required or incentivized by the City. The City can provide direct financial rewards, such as it now does for low gallon per flush toilets[3], or it can develop a more complex system to build it into tax or utility fee structures. Techniques to be considered at this stage of development include rain barrels, cisterns, green roofs, pervious pavers, and drought resistant landscaping.

Cisterns and rain barrels rainwater collected from roofs. They can provide water for garden or lawn irrigation, reducing water bills and conserving municipal water supplies. The City currently provides a rain barrel guide for homeowners and contractors.

Figure 3. Example of a residential green roof

Green roofs are partially or completely covered with plants. Used for decades in Europe, green roofs help mitigate the tendency for urban areas to have higher

[2] Subject to an engineering and biological investigation of such treatment systems.

[3] The City currently provides rebates for new construction for installation of WaterSense 1.28 gpf toilets in lieu of standard 1.6 gpf toilets. The rebate amounts to $35 for the first toilet, $25 for the second, and $15 for the third in the same residence or business.

summer temperatures, and reduce peak stormwater flows. The vegetated cover also protects and insulates the roof, extending its life and reducing energy costs. Typically the roof is planted with shallow-root drought resistant plants such as sedums.

Permeable and porous pavements come in many varieties, and allow water to infiltrate through the paved surfaces. Options include porous concrete and asphalt which can be used in the street designs of new development, and plastic grid systems and interlocking paving bricks for use on driveways.

Figure 4. Pervious pavers in parking strip (City of Portland 2006)

Storm Drain Stenciling

The city invests in a program to stencil "Dump No Waste - Drains to Stream" near storm drains in public roads. Reminding residents that everything entering Ashland Storm drains flows into streams and waterways is an effected reminder of awareness enhancing method. The City's expressed purpose of the program is "to help prevent water pollution and protect fish and wildlife by stenciling the words." As will be discussed in a later section of this report, the relative advantage of sustainable innovation is sometimes realized in social phenomenon. To optimize the use of green design, construction, and operations of the infrastructure in the Normal Avenue neighborhood, it will be important to have the support and eager participation of the residents of the neighborhood (Rogers 2003). It is therefore recommended that the storm drains, if and where they are needed in the future design of the area's stormwater system, should be marked with the stencils by the future residents, as a public-private event, rather than requiring the stenciling from the contractors.

LEED ND for Stormwater

The USGBC, LEED ND Rating system awards a neighborhood from one to four points for sustainable stormwater management. The intent is to reduce pollution, flooding, promote aquifer recharge, and improve water quality. A comprehensive green stormwater management plan for the whole project is required. Interestingly, this national system requires the management plan to use Best Management Practices (BMPs) from the Washington State Department of Ecology's Stormwater Management Manual for Western Washington. The rating systems awards one point for retaining 80% of the percentile rainfall event, up to 4 points for retaining up to 95%. Stormwater BMPs (except cisterns) must be designed to drain down within 72 hours (USGBC 2009). This will require consideration in the selection of methods for Normal Avenue, where the Class D soils drain poorly (USDA 2012).

Water and Wastewater Systems

As the Normal Avenue area is developed, infrastructure extensions will be required. Water, electric, and telecommunications infrastructure can be extended at relatively low costs, and are often not the subject of detailed sustainability planning. However, if the area were to pursue development as an ecodistrict, and centralize some of the infrastructure, these can become part of a broad approach to sustainable development.

The study area is encircled by the City's sanitary sewer system. As shown below, gravity mains are located along Clay Street to the east, Walker Street to the west, East Main Street to the north, and through the neighborhood south of the railroad tracks. Within the study area, only the Temple Emek Shalom is served by the wastewater system.

The primary method to alleviate the demand for water and wastewater treatment is to minimize effluent. For the right-sized system that is constructed in the Normal Avenue neighborhood, the following LEED for Neighborhood Development credit provides a useful metric.

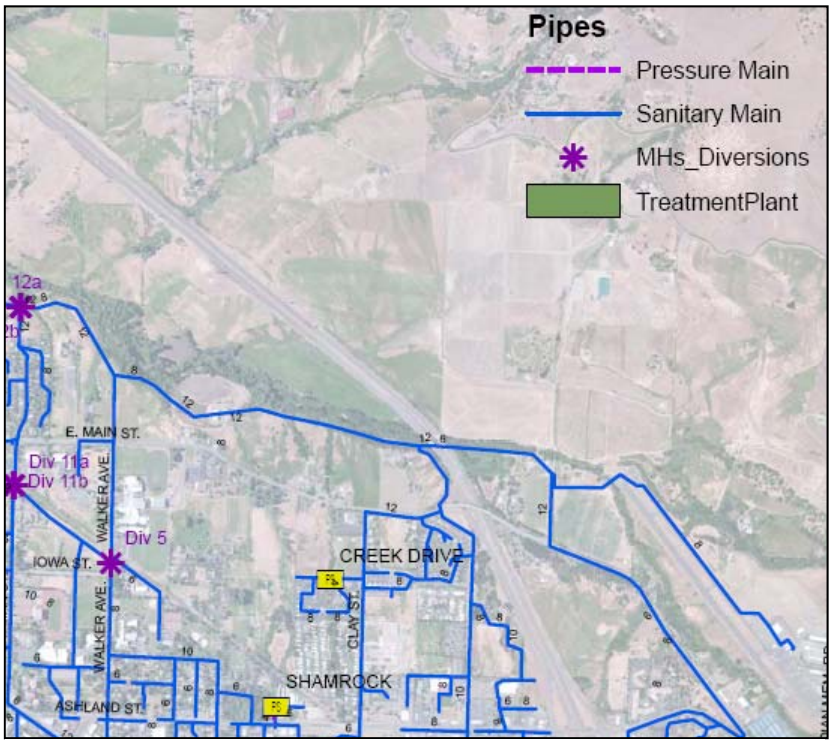

Figure 5. Existing Wastewater collection system (from Appendix A of Wastewater Master Plan)

Within the LEED ND rating system, one point is awarded for a neighborhood that has Recycled Content in Infrastructure. To be awarded this point, under Green Infrastructure and Buildings, a project must use recycled and reclaimed materials to reduce the adverse environmental effects of extracting and processing virgin materials (USGBC, 2009).

The Normal Avenue would have to use infrastructural materials for which the sum of postconsumer recycled content[4] and one-half of the preconsumer recycled content constitutes at least 50% of the total mass of infrastructure materials.

Total Materials/2 = Postconsumer RC + (PreconsumerRC/2)[5]

Materials used in the following are included in the assessment:

a. Roadways, parking lots, sidewalks, unit paving, and curbs.

b. Water retention tanks and vaults.

c. Base and subbase materials for the above.

d. Stormwater, sanitary sewer, steam energy distribution, and water piping.

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[4] For LEED ND, recycled content is defined in accordance with ISO/IEC 14021, Environmental labels and declaration, Self-declared environmental claims (Type II environmental labeling).

[5] RC = recycled content

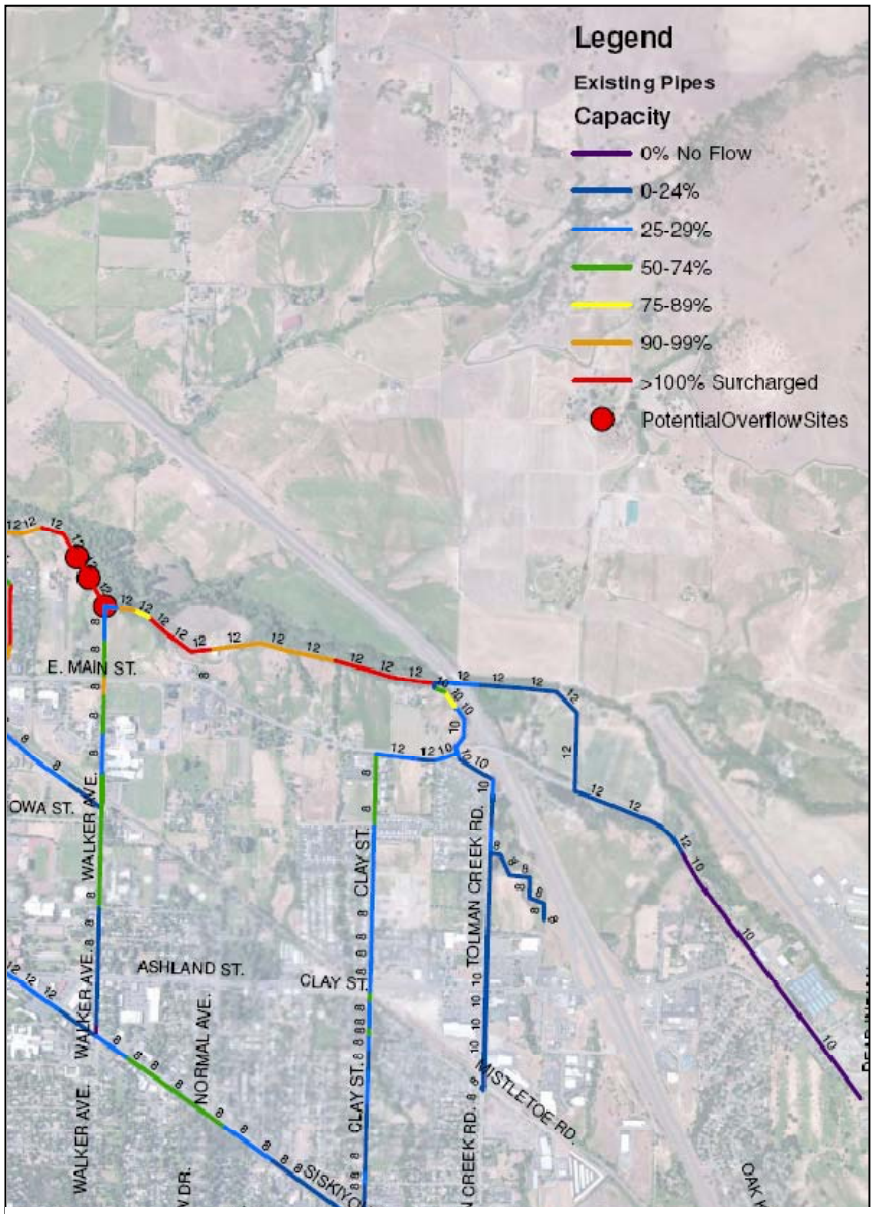

Figure 6. Existing Wastewater conveyance system (from Appendix A of Wastewater Master Plan)

Graywater Reuse

Graywater conservation systems, which are strongly encouraged by the City of Ashland, allow the reuse of wastewater from showers, bath tubs, washing machines, and bathroom sinks. The City should continue to promote these systems and require or incentivize them within the overlay for the normal Avenue neighborhood.

Water

The conveyance and delivery systems for water are relatively simple to plan and construct. However, the systems and use of water should be developed with a sustainable approach. Unless the City takes aggressive steps toward an eco-district, water reuse facility, the approach will focus on the end user, rather than the infrastructure system. The City has already developed programs and requirements which support water savings, such as the Site Design and Use Standards, Section III - Water Conserving Landscaping Guidelines and Policies. The section states how "Water has always been a scare, valuable resource in the Western United States, where winter rains give way to a dry season spanning five to seven months in the Rogue Valley." The City also recognizes the need for additional capacity in the Reeder reservoir or other systems. This system deficiency can be addressed with increased supply (additional water sources) or reduced demand (water saving technologies and behaviors).

LEED ND for Water

The LEED rating systems provide numerous ways of measuring the water savings of new construction. Much of it is tied to a percent savings from an assumed baseline. For Green Infrastructure and Buildings

(GIB), Credit 3, indoor water usage must be an average 40% less than in baseline[6] buildings. This or a similar goal should be incorporated into the requirements for new development. Also, GIB credit 4 requires water efficient landscaping. These benchmarks should be required for public infrastructure, and incentivized in residential construction. Credit 4 requires reduced water consumption for outdoor landscape irrigation by 50% from a calculated midsummer baseline. Reductions may be attributed to any combination of the following or other strategies:

a. Plant species, plant density, and microclimate factor.

b. Irrigation efficiency.

c. Use of captured rainwater.

d. Use of recycled wastewater.

e. Use of water treated and conveyed by a public agency specifically for non-potable uses.

f. Use of other non-potable water sources, such as stormwater, air-conditioning condensate, and foundation drain water (USGBC 2009).

Protection of Water Resources

The protection of water resources needs to be part of a systematic approach to design. There are synergies between the layout of the roadway network, development of the stormwater management system, and the design of parks and trails. Investigating these synergies at the October Charrette is critically important. Open Space and trail systems can feature access to water, boardwalks over the wetlands, and the recommended bioretention facilities. Not only will systems thinking about these designs and resources lead to a more desirable urban design, they can also reduce infrastructure costs, and maximize the available land.

Figure 7 Study area Water Resource Protection Zones

The City's Water Resource Protection Zones will need to be incorporated with any overlay zones or other requirements for such designs. Design goals should include a reduction of impervious surfaces, preservation of these creeks and wetlands, and onsite stormwater capture. To meet these goals, designers employ a variety of methods. To reduce impervious cover, they narrow streets and sidewalks, minimize cul-de-sacs, tighten parking spaces, and reduce the size of driveways and housing lots.

The green areas in Figure 7 are locally significant wetlands which consists of all lands with delineated wetlands and buffer of 50 feet. The orange lines denote local streams that are non-fish bearing. These require a 40 foot buffer from stream center line (City of Ashland 2011).

[6] Baseline includes 1.5gpf toilets, 2.2 gpm at 60 psi faucets, and 2.5 gpm at 80 psi showerheads.

Energy, Heating, and Cooling

According to the U.S. Energy Information Administration, buildings are responsible for nearly half of the CO2 emissions in the United States. Though less easily addressed and implemented than policies on other infrastructure, energy conservation should be addressed in the planning of the Normal Avenue neighborhood. The neighborhood plan should include energy conservation goals and techniques. Common and applicable energy reduction strategies include:

- Energy-efficient buildings
- On-site renewable energy (solar, wind, small geo-exchange [geo-thermal], small hydropower, biogas, and biomass)
- Planting plans for energy conservation and overall cooling
- District heating and cooling
- Waste-to-energy production (process of converting biomass, landfill gas, or municipal waste into an energy source such as electrical or thermal)
- Public education

Many of these strategies are implemented at the building level and not at the planning level. However, within the planning process, there can be consideration of district heating cooling, and electrical production. Typically, these strategies are part of the planning for areas that go on to become ecodistricts.

District energy systems are nearly twice as efficient as reliance on standard power systems which deliver to the residences around 40% of the energy generated at the main facilities. With a district level generation facility and plan, electricity does not suffer the typical transmission losses associated with most large-scale power systems. Also, heat can be captured and distributed throughout the neighborhood (City of Hillsboro 2011).

EcoDistricts

An ecodistrict is a neighborhood with a commitment to sustainability. The ecodistrict status is realized by many actions and investments including the completion of an integrated sustainability district assessment and action plan.

Ecodistricts develop a comprehensive management strategy for energy, water, waste, recycling, green infrastructure and mobility. And while an ecodistrict may not be practical for the Normal Avenue neighborhood a number of related techniques may be.

Small scale districts or neighborhoods provide the appropriate scale to employ integrated sustainability strategies because they concentrate resources and make size and risk more manageable. Examples include Western Harbor in Malmö, Sweden and Dockside Green in Victoria, Canada.

A district energy system could be studied for the Normal Avenue neighborhood. It would involve centralized generation of heating and/or cooling and potentially electricity. A central plant could provide the neighborhood (or the large area to make economic sense) domestic hot water and space heating and ventilation air. Electricity may be produced as a by-product of district energy with combined heat and power technologies.

Before an actual recommendation for a specific district energy system for Normal Avenue can be made, the fundamental case for district energy needs to be made. A detailed feasibility analysis would examine the technical and financial feasibility of district energy systems and make recommendations for the systems that offer the highest returns in terms of financial and environmental benefits.

Further Research

For additional information and collaboration on ecodistricts, developers and city leaders can reference the following:

In 2009, the Portland Sustainability Institute (PoSI) in partnership with the City of Portland established the ecodistricts Initiative. The Initiative provides tools, resources, and services (including consulting services) that could help Ashland create a successful policy framework and implementation strategy. The Portland Sustainability Institute hosts teams from many cities for ecodistricts educational programs and nurtures different areas of Portland as ecodistricts.

The City of Hillsboro and the firms Brightworks and Johnson Reid assessed the potential for an ecodistrict in the Hillsboro area known as Amberglen. They assessed a biomass district heating and cooling plant; and their report discusses factors that would need to be addressed in a full analysis of the economics of sustainable infrastructure systems and specifically, for a combined heat and power (CHP) system.

Uptake and Adoption of New Ideas

The City of Ashland will likely utilize a menu of options to encourage and require sustainable infrastructure development and site design. The City is already a leader in this regard with their work to promote graywater systems and other green building techniques. The following factors should be considered as the City considers whether green infrastructure is required, encouraged, or incentivized. Not only do these innovations need to be embraced by the developers who will design the Normal Avenue Neighborhood projects, but also by the Ashland Planning Commission and City Council.

The rate of adoption for an innovation is affected by multiple factors, such as relative advantage, compatibility, complexity, and observability (Tochen 2012).

Relative advantage is the perceived improvement of an individual's current situation (Greenhalgh et al. 2002, Rogers 2003, Weisburd and Lum 2005). While the improvement can be in terms of social status, economic profitability, or self-enhancement the implications for the City's attempts to encourage green construction are similar. Ashland already provides modest financial incentives for the purchase of water-saving fixtures, and invests in programs to promote and explain the technical details of green design, grey water systems, and sustainable ideas. These programs, as well as all public involvement related messages should be developed in consideration of this question of *relative advantage*. For example, the press releases, newsletters, and internet sites should focus on the relative water savings, and more importantly, the utility fee savings of rain barrels, low GPF toilets, etc. There are additional ways to show a relative advantage, by positively portraying the innovation, daring, and commitment of the developers and new residents.

Compatibility is an important factor in introducing innovations. Innovation must lend itself to the attitudes and beliefs and special circumstances of the population to which it is being introduced. Compatibility issues must address "existing values, needs, and past experiences of potential adopters (Arnould 1989, Greenhalgh et al. 2002, Ormrod 1990, Rogers 2003). If innovations are not compatible

with these categories it can impede adoption. Obviously, there are also compatibility issues related to the poorly draining soils in the study area, the likelihood of only having residential development, and the relatively low to moderate densities that are expected.

Complexity deals with the perception of how difficult an innovation is to use (Greenhalgh et al. 2002, Ormrod 1990, Rogers 2003). If it has a perception of high technicality and low ease of use then it will affect the rate of adoption, as people will feel that they do not have the skills to use the innovation. Workshops and tours of greenroofs, rain barrels and other recommended strategies will help to manage the issues associated with the complexity of these design features.

Observability can influence other members in a social system to adopt a new idea. They may see drawbacks and benefits to an innovation thereby reducing uncertainty about it (Arnould 1989, Greenhalgh et al. 2002, Rogers 2003). The environmental context of an innovation plays an important role in its diffusion (Ormrod 1990, Wejnert 2002). An innovation typically evolves to some specific indicator such as its "geographic settings, societal culture, political conditions, and globalization and uniformity (Wejnert 2002)." Since the green infrastructure recommended in this memorandum will be focused on an area already identified for a specialized plan, with relatively consistent infiltration and development patterns, the observable benefits of the initial development projects ought to help promote the continuation of sustainable approaches in later development.

Incentives certainly influence the adoption of an innovation (Savage 1985). There are many types of incentives such as mandates, subsidies, and discounts to serve as a mode of speeding up innovation adoption. Incentives and mandates play a major role in getting people to adopt preventive innovations (Rogers 2003). The City should look for opportunities to reduce "fees and taxes," including any and all utility fees, system development charges, etc. Another incentive for green building which the City can offer is recognition of the developers and the neighborhood residents as leaders in sustainability. Though this is a soft benefit, the City could recognize the first developers who embrace these elements in their Council meetings and in media releases. Such acknowledgement should have an indirect effect of the sales of lots, homes, and land within the study area.

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