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Title: Clean, Working Cities: A Synthesis of Business and Green Stormwater Infrastructure for Thriving Communities

Signature of Author: _____ Date: 4-14-16

Printed Name of Author: Melissa Zilinardt

Street Address: 32 Progress Dr.

City, State, Zip Code: Newmanstown, PA 17073

Clean, Working Cities: A Synthesis of Business and Green Stormwater Infrastructure for Thriving Communities

Melissa Zillhardt

Candidate for the degree

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Departmental Distinction in Environmental Studies

Barton Thompson, Ph.D.

David Osgood, Ph.D.

Cathleen Myers, J.D.

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Introduction

The American city is a thriving metropolis of innovation and cultural melding. Its cultivation in the American psyche of being on the cutting edge of technology and lifestyles has led many to interpret the crumbling infrastructure in its once booming manufacturing sectors to signal the decline of the American dream. However, while some of these abandoned manufacturing and business buildings may stand empty today, they may still have their part to play in the community landscape of tomorrow.

As I drive around the city of Reading, a city which my family has called home for generations, I am reminded by my parents of the days when each of the looming buildings was bustling with people, manufacturing goods and thriving in their personal lives. These now abandoned concrete, brick and mortar monuments , however, pose an environmental question as well as an economic one. A strong economy and vibrant business sector means more employment opportunities, a larger tax base and a community that can afford to grow and invest. At the same time, more businesses increase the need for impermeable surfaces such as pavements and concrete included in designs for sidewalks, roads, parking lots and buildings. Communities such as Reading must face the realities that many of their one bustling businesses sectors are now empty and unused, and re contributing to a compromised hydraulic system which needs to be fixed.

Urban hydraulics refers to the movement of water through the urban sectors. When rainwater passes over impermeable surfaces and through artificial channels it picks up speed and increases in volume quickly. The increase in the volume of stormwater leads to

an increase in sediment and pollutant loads carried by this water. Normally, rainfall is infiltrated into a natural system slowly by permeating soil and vegetation. When these natural systems are altered there is an increase in flooding damage. In order to avoid flooding and water damage, municipalities need to invest in gray infrastructure, including stormwater drains.

Where does all this water runoff go that is not integrated back into the ground? Storm drains are commonly used to funnel water away from buildings to a designated facility, however, all facilities have capacity limits and once these limits are met both sewage and stormwater are discharged into surrounding bodies of water and local flooding can occur. Flooding not only causes damage, but in many cities sewage runoff causes significant water quality problems in surrounding streams, rivers, and lakes. Urban centers faced with this problem must address how to monitor and re-design their stormwater infrastructure to mitigate the risk of sewage overflow.

In addition to sewage overflow, stormwater runoff can cause issues of retention in areas that are more arid. As stormwater is diverted into streams as it increases in speed and volume, the water does not follow its natural flow into groundwater supplies. The droughts in California and all over the country pose a significant problem for humans, animals, agriculture, wildlife, manufacturing, and emergency officials as the rate of unmanageable wildfires continues to increase. Wise use of water resources and the health of those resources are a global concern and will be increasingly relevant in scientific and governmental fields in the coming decades. Research in the field of urban water hydrology and runoff are imperative for the continued application of water-saving and collection technologies in the coming years.

The mounting problems regarding traditional stormwater and sewer infrastructure will become more urgent problems as cities and urban landscapes continue to expand into surrounding natural landscapes. Public and environmental health are at risk when such a precious resource as water is not contained within natural systems and is contaminated as it picks up debris and contaminates in the run-off.

Hypothesis

The City of Reading can increase the volume of incoming businesses, foster economic growth, and meet the requirements of the Clean Water Act by implementing a green stormwater management plan that encourages the retrofit of existing industrial buildings with green stormwater technology. By introducing a public policy which appeal to the monetary bottom-line of businesses, Reading will be able to create a competitive economy to encourage business investments and growth. I hypothesize that businesses will willingly retrofit currently abandoned properties to reduce surface runoff in exchange for cheap real estate and water-use credits. However, this hypothesis would need to be tested in practice, not theory. This project will test a subset of this hypothesis of whether or not a process can be created to financially incentivize companies to establish themselves in an area in exchange for retrofitting old buildings with green stormwater infrastructure. These the financial burden of these credits will be offset by a larger working population and thus a larger tax-base for the city. In addition, the city will be saving money by reducing the volume of polluted stormwater that they must clean in order to be used for human activity.

Background

It is often assumed that capitalistic economies are constantly at odds with the environmental movement. Capitalism is innovative; it solves problems through

competition and investment. Investment must come from capital or resources, and therefore treats the natural world as a bounty rather than a resource that should be managed in order to be of the most use for the longest amount of time. Robert Richardson states in his book *Building a Green Economy: Perspectives from Ecological Economics* that "conventional economics treats the environment as a subset of the economy from which natural resources are extracted for production, and into which waste is emitted" (p. 5). Richardson goes on to explain that in this type of system, environmental costs are often externalized (p. 5). This means that the cost of environmental degradation created from the waste outputs of business are not accounted for in the cost of the products or services they produce. By reducing stormwater runoff, a company is effectively "internalizing" some of their production costs because if the stormwater was allowed to flow naturally off of impermeable surfaces than the burden of the pollution the stormwater causes is bourn by the community and not the property that produced it.

An example of this kind of externality can be seen in organic vs. inorganic produce. An organic tomato at a local farmers' market may be more expensive than a non-organic tomato at a supermarket, but the organic tomato is actually cheaper in terms of its externalized cost because it does not result in the excess use of land and hydraulics that industrial agricultural processes do. In addition, the car emissions needed to transport the organic tomato are far less than the non-organic tomato, which may have been shipped across the country. The non-organic tomato most likely utilized more gas, pesticides, and water in its production due to intensive agriculture practices as well. In terms of energy expenditure and production costs, which produce wastes and bi-products, the organic tomato was actually cheaper to produce. Then why does it cost so much more? The answer

lies in the externalized costs borne to the community, which received the waste from production. This cost is not factored in to classical economic production and is therefore paid for by communities and taxpayers who suffer as a result of the producer's freeloading externalization through increased medical costs and loss of useable resources such as clean air and water.

While these externalized costs are primarily internalized by the communities in which they happen, businesses such as offices, apartment complexes, grocery stores and other establishments do pay taxes to cover some of the external costs that they produce in their communities. One particular tax, which is particularly relevant to water run-off costs, is sewer and stormwater taxes..

As of now, businesses existing within the city of Reading, as well as those merely conducting business in Reading, are liable to pay Business Privilege Taxes, which covers their business activities in the surrounding community (City of Reading). According to the *City of Reading Business Privilege Tax Regulations* Section I. II-1

any business that exists within the confines of the city limits is subject to city taxes.

However, taxes vary among cities, and thus it can be determined that the decision to conduct business in any one city may be as a result of their tax code. While there are a variety of reasons to anchor a business somewhere, including consumer base, location, and shipping routes, the amount that a business pays in taxes to a city can have a huge impact on their bottom line.

In June 2011 the City of Philadelphia decided that clean water and communities was one of their top priorities and subsequently founded the *Green City, Clean Waters* program (Philadelphia Water). Within the plan was an incentive for existing businesses to do their

part in ensuring clean water and a reduction in stormwater runoff by retrofitting their buildings to reduce runoff. The plan states that "Non-residential customers, including businesses, institutions, non-profits and public agencies, can reduce their stormwater rates and help clean up our waterways by implementing green infrastructure projects" and "projects that reduce the amount of impervious surface on a site can result in a stormwater credit that will permanently reduce your water bill" (Philadelphia Water, *Reduce Your Stormwater Fees*).

Like Philadelphia, Reading could also benefit from the use of such programs. Reading used to be a boomtown. As industry and production arose as a result of the famous Reading railroad, the city was bolstered around looming factories. As time passed however, and international trade and production became ever more globalized, Reading suffered. In 2011, the New York Times reported in its piece *Reading PA., Knew it Was Poor. Now It Knows Just How Poor* stating that in terms of national poverty ratings, "Reading began the last decade at No. 32. But it broke into the top 10 in 2007… now it is No. 1." There is no doubt that jobs have moved out of the Reading area, however its infrastructure remains.

Photo By: Melissa Zillhardt

I began to ask myself what the connection is between business and an area. What keeps businesses thriving, growing, and eventually becoming a staple of a community? What fosters such a relationship? In one word, interdependence: the fostering of a mutually beneficial relationship between city, business, and community. Therefore, my hypothesis controls for the economic interdependence between city and business. A compromise can be met in which businesses are encouraged to move into Reading while still protecting the environment by requiring said businesses to engage in the implementation and maintenance of green stormwater infrastructure in exchange for stormwater tax credits. In order to attract business to Reading incentives should be put in place. These will include the offer of cheap real estate in the form of currently abandoned industrial buildings. The plan will allow businesses to obtain these facilities at relatively low prices in exchange for the buildings and surrounding properties to be retrofitted with green stormwater

infrastructure. These buildings can be used for any type of business including retail, offices, restaurants, apartments, galleries or other facilities. These types of building exchanges have already proven both profitable and desirable in the community of Reading and surrounding areas as several businesses have been converted from manufacturing buildings and given new life. These include the popular restaurant Viva, the VF Outlets, The Works, and The Goggle Works.

The businesses will be required to manage a certain amount of rainwater on-site. This will reduce the amount of runoff into the street and will therefore save the city money via the decreased use of its stormwater system. In addition, a decrease in water runoff will result in a decrease in pollution entering the Schuylkill River. As water runs over impermeable surfaces it picks up debris, chemicals and motor oil. As Reading does not have a combined stormwater system this runoff is discharged into the Schuylkill untreated, as it does not pass through the subsequent sewer treatment facility. Reading's pollution accumulates with other runoff pollution as the river flows towards Philadelphia and into the Delaware Bay. The protection of waterways for both biodiversity and recreational reasons constitute a joint effort to maintain transparency and give communities the tools needed to ensure healthy aquatic ecosystems.

In addition to municipal, business, and environmental interests it is in the financial interest of a community to have a thriving job sector. As previously stated, Reading has not been economically thriving for the past few decades. Charles M. Blow states in his *New York Times* opinion piece "How Expensive it is To Be Poor" that "wealthy Americans believe 'poor people today have it easy because they can get government benefits without doing anything in return.' This is an infuriatingly obtuse view of what it means to be poor in this

country- the soul-rendering omnipresence of worry and fear, of weariness and fatigue. This can be the view of only those who have not known- or have long forgotten- what poverty truly means" (2015). Reading would outlandishly benefit from having a larger employed population above the poverty line. Those in the middle class spend money. They need to in order to survive and they also spend more on simple luxury items such as new cars, décor, clothes, and entertainment. As a community moves out of poverty its population thrives as they invest their money in their communities, bolstering economic activity and resilience. This type of middle-class earner also provides an increased tax base that helps the local municipalities fund projects that continue the growth and improvement of the community as a whole. If businesses can be attracted to Reading in an economically and environmentally sustainable way each entity will benefit greatly as the community becomes more complex and interrelated.

The Environmental Issue of Stormwater

It has long been established that human activity alters natural ecosystems at a rate in which these ecosystems are dramatically degraded and cannot adapt quick enough to maintain their stability and biodiversity. Adaptation takes thousands of years to construct and therefore any major changes in an ecosystem will have similar dramatic influences on the biodiversity of those ecosystems. Ecosystems thrive on biodiversity. The more complex a system is, the more stable it becomes. This is due to the fact that if there are many species that can fill the same job as another species, then if one species dies off the ecological web of life will not be as dramatically disturbed. However, in the short history of humankind, we have found ways to significantly alter water. Through pollution, damming, and irrigation we have altered the flow and composition of water sources to fit our needs. Intrinsic in the

altering of water sources is the altering of the water-based ecosystems these sources can support.

In their book "Rivers for Life: Managing Water for People and Nature," Sandra Postel and Brian Richter explain the connection between aquatic ecosystem health and human health. Postel and Richter point out that human pollution and development has resulted in a steady decrease in aquatic ecosystem health, particularly in freshwater systems. They state "as… freshwater habitats become increasingly altered, the composition and abundance of this critical assemblage of species will likely change as well- often in ways we cannot yet explain or predict, and with consequences that may be costly and irreversible" (p. 35-6).

The United States began monitoring the safety of waterways using the *Rivers and Harbors Act* of 1899 when the first piece of water-related legislation was passed (Goodstein p. 280). The main objective of this legislation was to mitigate the possible damage to boats as they carried cargo. At the time, many industries were dumping their manufacturing waste into waterways and this waste was clogging the rivers (Goodstein p. 280). These wastes were both chemical and physical. However, in 1972 the Clean Water Act was passed which established a rational for protecting, not only the physical structure of our nations waterways, but also their biological and chemical compositions for the direct benefit of human health and well-being. While this piece of legislation does have a primary anthropocentric theme, it initiated a wave of reforms at the federal, state, and local level to protect the health of waterways. The Clean Water Act states in Section 101(a) that, "The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nations waters" (Federal Water Pollution Control Act p. 3).

The mechanisms that pollute waterways are wide and varied. These can include both point and non-point pollution sources. Non-point pollution occurs when the place of origin of the pollution cannot be exclusively determined, such as random pieces of trash in a river. I will be focusing on non-point polluters via stormwater systems. Stormwater is any water that flows over impermeable surfaces such as concrete, asphalt, and rooftops (Philadelphia Water, *Stormwater Management*). These surfaces do not allow water to be reabsorbed into the ground as would normally happen in the natural environment. Instead the culmination of this water increases speed and volume as it flows towards the lowest point. The rapid movement of this water is what causes flooding events as the infrastructure, including natural bodies of water, cannot absorb large, cumulative amounts of runoff over a short period of time. Most of the time we think of the lowest point as a sewer grate. However, it should be noted that sewer grates should not be an afterthought as they do empty their contents somewhere.

In some cities, grates lead into a Combined Sewer System in which both sewage and stormwater are treated. These types of systems function as "a single pipe [which] carries both stormwater from streets, houses, and businesses as well as wastewater from houses and businesses to a water treatment plant" (Philadelphia Water, *Stormwater Management*). The issue with these types of systems is that they only have a certain capacity for treatment. In cases where stormwater exceeds this capacity, such as during a large rainfall event, "both are discharged into the city's streams at a Combined Sewer Outfall before it is treated" (Philadelphia Water, *Stormwater Management*). It is not difficult to understand the issue with discharging sewage directly into a body of water untreated. Such sewage increases the risk of human diseases and is problematic for the ecology.

Fortunately, the city of Reading does not operate under a Combined Sewer System, but rather a Separate Sewer System. Under this system, all stormwater is directly discharged into a body of water without treatment. While this type of system does not possess the urgent public health implications that combined systems do, it still has its problems. The issue lies in the transportation of pollutants from impermeable surfaces to bodies of water.

During a normal rainfall event most natural landscapes are able to absorb water through plant and soil structures. In areas with poor drainage the landscape primarily consists of swamp and marshland. As water is allowed to permeate the soil, or evaporate, filtration occurs. However, without these biological processes pollutants are not removed from stormwater. Trash, chemicals, fertilizers, biological debris such as leaves and grass clippings, and petroleum residues are all picked up from roads and sidewalks and eventually discharged into rivers and streams. These components change the water chemistry of rivers and detract from organisms' ability to thrive in their environment. Not only is the biodiversity of such bodies of water threatened, but also human health. As water is used from these bodies of water for drinking and recreation a certain kind of care must be met. It costs money to filtrate water in order to make it suitable for human consumption. At the same time, nobody wants to swim or fish in a body of water that has pollutants that could possibly have a negative effect on human health.

The city of Reading can be used to illustrate the dynamics of this process. Reading used to host battery manufacturing. Around such manufacturing plants there are several streams. Even after the plants have been shut down for years there is still a remarkable lack of vegetation surrounding these streams because of the runoff from the manufacturing

process, which left toxic chemical in the surrounding sediments. If such biological agents can harm foliage there is a good chance that they may also have a negative impact on many other species as well as human health.

If we cannot fully recognize and track where each portion of pollution that enters our streams and rivers comes from, then we cannot help but assume that this pollution will make it into rivers. However, there is an effective way to mitigate the amount that does make it into rivers and streams by decreasing the mechanism that transports it. By reducing the volume of water running over impermeable surfaces during rainfall events we can therefore decrease the rate of water run-off, and consequently, pollutants. Not only does managing stormwater on site reduce the amount of water that comes in contact with impermeable surfaces but also reduces the instances of stormwater grate back-ups which may cause property damage and basement flooding. In addition, less pollution in the water decreases the need for treatment, protects the biodiversity of water systems, and allows localities the ability to meet designated water uses by the state since the ability to use water is based on the cleanliness of that water (Philadelphia Water, *Stormwater Management*).

Green Stormwater Infrastructure

The issue of stormwater runoff and how it can negatively affect buildings and structures has long been addressed in zoning codes. Only allowing certain structures on a piece of property as well as the dimensions for those structures helps to channel only a certain amount of runoff into a designated area in order to avoid flooding, rotting, and structural damage.

Municipalities often bear the brunt of the damage when it comes to stormwater runoff and flooding. The strain on current infrastructure is ultimately the responsibility of the municipality to replace and fix. Cleanup efforts after extensive flooding cost thousands of dollars and often impede movement of pedestrians and motor vehicles for days. These events can have a significant negative effect on the economy of local communities. However, in the past few decades more stormwater mitigation techniques have come into practice, which draw from nature in their designs.

The technical green stormwater designs encourage the use of water rather than just funneling water into a nearby creek or river. In doing so, water is contained on site and is utilized by plant life, as well as the refilling of groundwater sources, as would normally occur in nature. As water is contained in an underground root network of plant life it is filtered through the plants. Water is also physically filtered through soil. These processes save human-based technical design from cleaning the water through mechanical means.

Biomimicry is a design structure that takes the design of nature and applies these design principles to man-made designs. Such an example includes the use of CO_2 to make biodegradable plastics just as plants use CO_2 to make long glucose and polycarbonate chains, as outlined in Janine Benyus's Ted Talk *Biomimicry's Surprising Lessons from Nature's Engineers* (2005). Biomimicry is the use of natural design to inspire other designs and is therefore different than using natural processes as they were intended. The use of such processes, however, does include a fundamental understanding of the free processes that our biological world provides. The sequestration of CO_2 to create oxygen is one of the "free" processes that nature provides. The theory of economic and demographic transitions employs the idea that humans do not need to restrict ourselves in the natural world as we

will be able to create technical solutions that can replace many natural processes. However, in a finite world, there is a question as to whether our "technological" solutions are able to be sustained. Therefore, creating technical solutions from natural design, as well as appreciating and understanding the wealth free services that nature provides, is paramount in our economic wellbeing. Why pay for something that is already being done for free?

Not only do plants sequester carbon to produce oxygen, but they also cleanse water sources. In terms of the treatment required to make polluted water usable for cooking, drinking, recreation as well as the use as a healthy biological system, humans are paying for technical solutions when natural solutions are sitting right under our noses. There are several technologies available that have been proven to reduce pollutants in wastewater through natural processes. One of these is called Biofiltration. Such a system is designed to direct runoff through dense vegetation and soil in order to remove pollutants and toxins. B. E. Hatt et al. study, "Pollutant removal performance of field-scale stormwater biofiltration systems" concluded that plant and soil based systems are extremely reliable and effective at removing criteria pollutants from stormwater. In the study the scientists measured total suspended solids (TSS), copper, lead and zinc in stormwater to assess the effectiveness of plant life on reducing these pollutant loads. The study stated that it "confirmed findings of previous laboratory studies, that is, biofiltration systems efficiently and reliable remove TSS and heave metals" (p. 1575).

Potential Solutions to Contaminated Stormwater Runoff

There are several technical variations that can be suited to different types of building situations, which have been employed on both of buildings and at street level. One

of the most unique and usable in urban situations is a permeable pavement. The Environmental Protection Agency outlines this tool in their municipal handbook *Managing Wet Weather with Green Infrastructure: Green Streets*. They state that, "Urban roads, along with sidewalks and parking lots, are estimated to constitute almost two-thirds of the total impervious cover and contribute a similar ratio of runoff" (p. 1). Permeable Pavements include setting grids of concrete with small gaps in between in order to encourage infiltration of water. They also have the additional benefit of reducing "vehicle hydroplaning and… road noise" (*Green Streets* p. 6). They can also be visually equivalent to traditional types of asphalt. These types of permeable pavements "provide the structural support of conventional pavement but it made of up a porous surface and an underground stone reservoir. The stone reservoir provides a temporary storage before the water infiltrates the soil" (Philadelphia Water, *Green Stormwater Infrastructure Tools*). These types of pavements can be used for sidewalks, ally-ways, and low impact streets. Underneath these pavements may lie a small storage space where water can gather as it slowly soaks into the ground underneath in order to encourage large amounts of water to permeate the surface.

Another type of sidewalk and street innovation is the use of a stormwater tree trench. This trench funnels water into a tree planter box, which is constructed over a pit of stone, gravel or soil. The use of trees to soak up water in addition to water being able to soak into the groundwater supply decreases the likelihood of overflowing and not being able to contain as much runoff (Philadelphia Water, *Green Stormwater Infrastructure Tools*).

Similar to the tree trench is a stormwater bump out. In this situation, the curb or corner of a street is increased in size in order to create an area where plants can lie in order to catch stormwater. Small grooves are added on each side of the plants in order to channel water into them. In addition, stormwater planters can be added in the medians between sidewalks and curves. These planters are dipped, filled with shrubs, and often contain fencing around them in order to prevent pedestrians from walking into them. Their dipped structure, along with carved channels on each side allow for more water to be contained within their structures (Philadelphia Water, *Green Stormwater Infrastructure Tools*).

In terms of structural ways to reduce runoff, some may use rain gardens and actual runoff "containers." These types of tools retain a certain amount of runoff that is either slowly taken up by plants and then evaporated, or is contained until the water can be used for another purpose. Rain gardens consist of a moderately depressed area of land filled with native plants known to soak up a lot of water. The *Lady Bird Johnson Wildflower Center* database run through the University of Texas at Austin provides and comprehensive list of native species, which thrive in wet climates, based on location. Rain gardens work by allowing water to pond on the surface for use by plants and then slowly infiltrate the soil. This process usually occurs slowly over 72 hours (Philadelphia Water, *Green Stormwater Infrastructure Tools*). This tool could be used extensively in the implementation plans constructed by businesses that wish to employ rain-gardens as part of their institutional plan in order to reach their "on-site retention" goals.

In addition to rain gardens, several "container" tools may also be employed. These include rain-barrels and flow through planters. In each of these situations, water is directed from gutters into the storage containers. Rain barrels store such runoff and can then the

water can be used for non-drinking or cooking purposes. These can include watering plants or washing vehicles. Flow-through planters are boxes or containers, which are filled with plants, gravel, and soil. A water source, such as a downspout, is directed into the box and the plants inside slowly take up the water (Philadelphia Water, *Green Stormwater Infrastructure Tools*).

One of the most useful structural tools are green roofs. Timothy Carter and Laurie Fowler state in their piece *Establishing Green Roof Infrastructure Through Environmental Policy Instruments* that, "Green roofs typically contain layers of engineered growing median and drainage materials which are incorporated into a roof membrane and support plant communities which are tolerant of the extreme weather conditions found on rooftops" (p. 152). There are two types of green roof structure, extensive and intensive. The difference between the two involves how deep the root and soil structure are each type of roof. Extensive roofs contain at least 6 inches of drought-tolerant plants, succulents and grasses (Philadelphia Water, *Green Stormwater Infrastructure Tools*). This depth includes both the plants as well as the soil. Intensive green roofs are any structures deeper than 6 inches. In terms of retention, green roofs can provide the bulk of reduction for businesses as most office and industrial buildings have flat roofs. For example, a green roof containing 2.5 inch thick extensive green roof would retain about .5 gallons of water per square foot during a 2 inch rainfall event. This results in about 40% retention rate (Scholz-Barth, p. 5). Green roofs also provide the added benefit of insulation that reduces the building's energy requirements as well as "air quality is improved as the plants will uptake NOx and CO_2, common greenhouse gasses, from the atmosphere" (Carter and Fowler, p. 152). It is important to address that as the purpose of a green roof is to reduce water runoff, it also

has benefits that are primarily internalized by the owner of the building including lower energy costs and rooftop beautification. One of the main issues with private markets producing public goods is the lack of private gain for such efforts. For example, a private entity may not wish to build a public road if they cannot be ensured that all people will pay to use the road due to the free-rider problem. A public road is just that, public. However, if there is private benefit to gain as a supplemental result of providing for the public good, in this case reducing stormwater runoff, then the likelihood that private businesses will see the value in this type of good will be increased.

Green Stormwater Infrastructure Case Studies

Boise, ID

The city of Boise, Idaho faces similar pressures that all other cities face in trying to achieve the standards set forth by the Clean Water Act. According to a study funded by the Conservation Economics Institute for Idaho many stormwater management practices "have been moving towards stormwater infrastructure that can retain and infiltrate stormwater onsite" (p. 3). The study was based on calculating the economic benefit and cost-effectiveness of both traditional grey infrastructure systems in comparison to green stormwater systems. Their grey infrastructure systems included "conventional trees without suspended pavement systems and conventional paved alleys" intended to reduce runoff (p. 3). The green infrastructure solutions included "trees with suspended pavement systems, permeable pavers, and bioswales" (p. 3). The costs of these two types of stormwater infrastructure practices were construction materials and maintenance.

The study concluded that while green stormwater infrastructure has higher initial costs as compared to grey infrastructure, it also has a longer lifespan and is more effective

in reducing runoff (Conservation Economics Institute for Idaho, p. 3). Not only did the study take into account the economic benefit of longevity and the usefulness in its ability to retain large amounts of water runoff, but they also took into account the societal benefits that such green infrastructure provides. These types of benefits are not easily calculated, and so are often left out of economic assessments. However, the emotional and visual effects on a community are just as important as physical and structural benefits of any infrastructure. For example, if structural integrity were the most important aspect of buildings, architects would stick to original designs that they know to hold up well in certain environments. Without the aesthetics properly expanded and considered in buildings, we may not have ended up with structures such as the Eiffel tower, the space needle or any other building that draws attention as it is visually appealing and different. Social benefits do not merely stop at aesthetic value but also include "clean drinking water, water supply, clean air, recreation, pedestrian and vehicle safety, reduced heat island effect, and education and community engagement" (Conservation Economics Institute for Idaho, p. 15).

The study addressed the inability to accurately understand the value that individuals in a community may have for protecting water supplies. In order to control for these measures, the study cited an experiment in which people were asked how much they would individually contribute to protect their community's groundwater supply. The results from this survey indicated that "contingent valuation studies for protecting groundwater… found an average willingness-to-pay of $531-$736 per household" (Conservation Economics Institute for Idaho, p. 16).

The study eventually found that the most cost-effective mechanism for reducing stormwater runoff is permeable pavers. In comparison to conventional pavement, the permeable pavers cost $8 per lb. of TSS (Total Sediment Suspended) reduced and the conventional pavement cost $30 per lb. of TSS reduced. The reduction in TP (total phosphorus) was even more dramatic as the cost per lb. for permeable pavers was only $1,685 in comparison to $6,273 for conventional pavers (Conservation Economics Institute for Idaho, p. 17). In addition to cost savings, the study also reported that property values increased 3-5% in the presence of green stormwater infrastructure. There was also a 3.86 lb. reduction in pollutants from trees in a given year (Conservation Economics Institute for Idaho, p. 20).

Lancaster, PA

In February 2014 the EPA conducted a case study to characterize the cost-savings of implementing green infrastructure in Lancaster, PA. The study controlled for the predicted savings over a 25-year period if traditional grey infrastructure were to be replaced with green infrastructure. In the summary of the possible water-related benefits the plan implemented "green roofs, tree planting, permeable pavement, bioretention, and rainwater harvesting [to] help reduce the volume and rate of runoff entering sewer systems" (*The Economic Benefits of Green Infrastructure: A Case Study of Lancaster, PA, p*. 6). The study was conducted using the annual average precipitation of Lancaster of 42.04 inches/year. Overall, the study concluded that by utilizing green infrastructure the city would save $661,000 in pumping and treatment costs per year, as well as a reduction of $120,000,000 in grey infrastructure capital costs over the 25-year period (*The Economic Benefits of Green Infrastructure: A Case Study of Lancaster, PA, p*. 7).

Philadelphia, PA

One of the most comprehensive green stormwater management plans has been implemented in Philadelphia, PA. Their *Green City, Clean Waters* program was designed in response to issues involving the overflow of their Combined Sewer System. As previously mention, a Combined Sewer System encompasses both sewage as well as stormwater runoff. If the flow through this system exceeds the system's capacity, then both sewage and stormwater can be discharged, untreated, into a source of water. Instead of tearing out the old system and replacing it with a new separate system, Philadelphia decided to work above ground, mimicking the natural cycles and flow of water into a design that would "green" the city. The goal of the program is simply put: "We're recreating the living landscapes that once slowed, filtered, and consumed rainfall by adding green to our streets, sidewalks, roofs, schools, parks, parking lots and more" (Philadelphia Water, *Green City, Clean Waters*). When the project is completed, the city will have reduced their water runoff by an astounding 85% and will have saved them approximately $5.6 billion while simultaneously adhering to the requirements of the Clean Water Act.

Philadelphia's program focuses not just on what they city can accomplish in terms of creating green infrastructure, but also on bringing communities and businesses into the greening process. Their website includes a comprehensive list of stormwater reduction techniques that can implemented on private residences and how to build these structures. The same kinds of instructions are also available for businesses in order to comply with building and zoning regulations. In order to encourage businesses to engage in mitigation techniques, the city provides a simple GIS analyst tool in order for businesses to evaluate their current properties and estimate how much they could save in stormwater fees by

retrofitting their buildings. In addition to the economic benefits to businesses, there is also an economic benefit to green workers. In order to implement this program, the city employs researchers, contractors and other workers.

Laws and Regulations

The Clean Water Act (Federal Water Pollution Control Act) was the first major law to regulate water pollution. The Federal Water Pollution Control Act was first published in 1948 and was primarily designed to address physical strainers in waterways, such as sawdust and garbage, which obstructed these waterways for travel. However, after the 1972 amendments the act officially became known as the Clean Water Act. The amendments to the act increased the EPAs ability to both monitor and regulate point and non-point source polluters whose inputs degraded water sources. Some of the amendments included regulating discharge, setting wastewater standards, set water quality standards, prosecute polluters, fund sewer treatment plants, and address the need for planning to control pollution. (EPA, *History of the Clean Water Act*).

All states need to comply with the national standards outlined in the Clean Water Act. In order to monitor these standards, the EPA has created the NPDES (National Pollutant Discharge Elimination Systems) permitting program for states. These permits regulate how much pollutants point sources can discharge into waters. Under current standards, all but four states are able to issue permits to polluters in their area (EPA, *Clean Water Act Compliance Monitoring*). The monitoring of these point sources is maintained at the state-level and therefore requires less federal oversight.

In addition to industrial point source polluters, the Clean Water Act also includes stormwater discharge as part of "point sources." According to the EPA website "The CWA,

and its implementing regulations, requires that certain industrial facilities, construction sites, and municipal separate storm sewer systems (MS4) obtain coverage for their stormwater discharges under an NPDES permit, develop a Stormwater Pollution Prevention Plan (SWPPP) or Stormwater Management Plan (SWMP) and put measures in place to prevent discharges or pollutants in stormwater runoff" (*Clean Water Act Compliance Monitoring*).

MS4s are Municipal Separate Storm Sewer Systems, which are "owned by a state, city, town, village, or other public entity that discharges to waters of the U.S." (EPA, *Stormwater Discharges for Municipal Sources*). Phase I of the NPDES stormwater regulations governed larger cities, such as Allentown. Under Phase II of the MS4 permitting program, permittees are required to create Storm Water Management plans in order to reduce the amount of pollution resulting in bodies of water from stormwater runoff. These plans must contain "six minimum control measures described in the storm water regulations" (EPA, *Measureable Goals Guidance for Phase II Small MS4s*). These include: Public Education and Outreach on Storm Water Impacts, Public Involvement/Participation, Illicit Discharge Detection and Elimination, Construction Site Runoff Control, Post-Construction Storm Water Management in New Development and Redevelopment, and Pollution Prevention/Good Housekeeping for Municipal Operations (EPA, *Measureable Goals Guidance for Phase II Small MS4s*). For each of these categories, the MS4 must compile Best Management Practices (BMP) in order to meet these requirements. The goal of these plans is to reduce the discharge of pollutants to the "maximum extent practicable," protect water quality, and comply with the water quality requirements set out by the Clean Water Act.

One of the most important parts of these plans is the development of measureable goals. It is important that each MS4 zone is able to create their own plans and objectives in order to control for the "unique local, hydraulic, geologic, and water quality concerns of different areas" (EPA, *Measureable Goals Guidance for Phase II Small MS4s*). Through these practices the MS4 is able to tailor their goals to meet their specific biological controls. For example, the MS4 may want to specifically protect a certain lake or ensure that municipal and recreational activities are not significantly hindered on a certain body of water. The measureable goals allow the MS4 to quantify their goals and attainment practices so that they can track improvement in water quality as they continue to implement their BMP. Measureable goals include the specific actions that will be taken in order to ensure compliance with the six control measures outlined in Phase II. The goals will also include tracking mechanisms so that future assessments can focus on baseline statistics in order to tack progress and make systematic changes accordingly (EPA, *Measureable Goals Guidance for Phase II Small MS4s*).

Hydrology, Regulations, Budget, and Stormwater System of Reading

The city of Reading sits to the East of the Schuylkill River and is contained within its watershed. The city lies on top of a ground rock layer of Dolomite and Limestone. Its soil is categorized under both the "low infiltration" and "very low infiltration" rate categories (Appendix B) as one moves from east to west towards the river (*Tributaries to the Schuylkill…*). Water flows from Mt. Penn down to the Schuylkill at a high runoff rate, which is accelerated by the abundance of impermeable surfaces.

The city of Reading is regulated under Phase II of the MS4 permitting program. It has a separate stormwater system which discharges directly into the Schuylkill River. The

City is governed under the *Schuylkill Watershed Conservation Plan* of 2001 to meet the Best Management Practices and Measureable Goals requirements of the program. One of the priorities in this plan includes "addressing impacts of urban development/impervious cover, runoff as part of precipitation, [and] roads and streams crossings" (County of Berks, *Schuylkill River Act 167 Plan: Berks County Section*). The Act created five goals that the watershed is going to achieve in accordance to Phase II. These include: Maintaining groundwater recharge, implementing non-point source pollution removal methodologies, reduce channel erosion, manage overbank flood events, and manage extreme flood events. Interestingly enough, Table V-9 of the act lists a few alternatives to reduce stormwater runoff on properties as BMPs including rooftop gardens, cistern storage, porous pavement, vegetated ponding areas, and gravel trenches (County of Berks, *Schuylkill River Act 167 Plan: Section V. Criteria for Stormwater Control*).

The Reading Area Water Authority is the entity that is responsible for maintaining clean tap water for the city. In their annual budget report for 2015 they allocated $3,956, 217.12 in their water purification budget. Their total revenues expected for 2015 totaled in $34,246,786.44 and their total expenditures resulted in $37,246,786.44. Therefore, following the 2015 fiscal year, their total debt was $3,017,220.08 (Reading Area Water Authority). They also compile rates for water use and collect such rates.

In reducing stormwater runoff the city may be able to reduce expenditures from the need for greater purification techniques. By encouraging reducing surface runoff less pollution will be able to make it into drinking water supplies, which will result in lower costs for purification, culminating in cost savings on the end of the municipality.

Standardized Plans

The City of Reading must already submit a plan to meet the EPA requirements that govern their MS4 permits. Already within their plan is the choice that personal landowners and businesses may make in order to meet their "point source" runoff status by employing green stormwater runoff mitigation techniques as outlined in the Act 167 plan. Therefore, I do not believe that the city will have a systematic issue with allowing businesses to use these types of tools and techniques in order to mitigate their runoff. By encouraging the use of these tools, the city is expanding its actions to meet the requirements of the plan they themselves have set out to deal with the issue of water pollution.

My plan focuses on the ways that the city can use the attractiveness of these tools in order to attract businesses to employ them in exchange for stormwater credits. Under this system, a business would receive a certain dollar amount off their water bill for each fiscal year if they meet the reduction in runoff requirements for the previous year. Therefore, for the first year that the tools are implemented, monitoring would occur in order to ensure that stormwater runoff is reduced by 25% for each individual source. This should be a fairly easy task due to the fact that a well-established rooftop garden itself can reduce runoff by 40% (Scholz-Barth, p. 5).

The program I am proposing does not halt at the benefit to currently existing businesses in Reading, but its main audience is attracting new businesses to the area. In the wake of the recent recession, starting a new business can be a daunting idea. In such instances of economic stagnation, it is the duty of government to try and relieve some financial burden in order jumpstart businesses and entrepreneurial activities, which in turn correlate into jobs.

Some may suggest that governments are in no position to currently help, however, my plan creates a mutually beneficial relationship between business and government in which the municipality will save cleanup efforts to maintain clean drinking water standards, not only in Reading but also for municipalities touched by the Schuylkill River and its Basin. In addition, the presence of jobs in an area increases tax bases, thus increasing revenue for the municipality to continue efforts to improve the community. The following program plan and contract are designed to measure the highest dollar amount that businesses would be responsible for investing in this project at the lowest cost to the municipality.

Methodology

In order to attract businesses to accept this proposed program, I identified several variables in order to gain the most financial profit for the City in reduced cleanup efforts. The Agreement of Sale contract (Appendix A) was altered from an original copy provided by Kelsey Frankowski, Esquire of Georgeadis and Sentley law group. Within the document are highlighted the purchase price for a sample property as well as the property address. The experimental property is currently located at 1830 N. 11th St. Reading, PA 19604. A Geographic Information Analysis of the site concluded that there is approximately 19,840 square feet of impermeable surface on the parcel site. This includes parking and paved areas. The building itself has 5,123 square feet of impermeable surface in roof area.

The cost for the property is an estimate based on the current mortgage for the property adjacent to it. The Humane Society owns the adjacent property and its mortgage information was collected from the Berks County Public Records: Recorder of Deeds. The estimate of the price for 1830 N. 11th St. Reading, PA 19604 will be set at $350,000 due to

the price of properties surrounding it. The price of the property will be one of the variables that are negotiable in the contract. The building contains a small, two-story brick building and a longer attached garage. The structures sit on a small, wrap-around parking lot. The roof is flat and therefore is idea to implement green roof technology.

The other variable will be the cost of water as provided by the Reading Water Authority. It is assumed for this assessment that any commercially zoned building will require the 10" meter size as included the Water Authority's 2016 rate structure. The use of water depends upon the type of business that moves into each facility. For instance, an office building will use less water than a restaurant might. For this assessment, the service charge for a 10" meter is $2,275.83. The Service charge for the fire connection is $351.15. The Connection fee is $4,222 and the Tapping fee is $346,955 for an average 6" main.

The Consumption charge for the first 750,000 gallons of water is $8.21 per 1,000 gallons used. The next 3,000,000 gallons used comes at a rate of $7.18/1,000 gallons. Any water use over 3,750,000 gallons comes at a rate of $6.07 per gallon. However, these rates will not be calculated into the first year savings for a business as they will be unknown.

Overall, the known yearly water costs for an average business building containing only one business will be estimated at $353,803. This estimate does not include water-usage. When combined with the cost of the experimental property would cost $703,803 before usage costs.

Primary Contract

The contract (Appendix A) will be the first of three contracts presented to the business owners. It is the least expensive contract on the part of the City and therefore acts as the baseline to assess the willingness of a business to accept such a contract. In it, the

price of the property is kept at its full amount of $350,000. As such, it outlines payment methods to the "seller" as well as the use of the property. Under *Exhibit A* on the last page, the details of the program requirements are outlined for the business. Under this first contract, the "buyer" agrees to pay full price for the property as well as fund the costs of the retrofits. The retrofits must consist of Green Stormwater Infrastructure technology. The "buyer" is given the option of either working through a municipal-approved contractor who is familiar with these types of retrofits, or work alone on the project and its implementation. The "buyer" must submit their retrofit plans to the Department of Public Works for approval within 6 months of purchasing the property. A list of possible technologies that have already been approved are outlined for the" buyer." The "buyer" may research these technologies independently, but they will be given access to documents outlining these technologies as provided by the EPA.

The "buyer" is required to foster a stormwater retention rate of 25% for a normal, 2-inch rainfall event. An assessment of the parcel and property's current runoff rate will be calculated by the Department prior to the sale of the property. The cumulative retention rate of all techniques used on-site will be used to reach the goal of a 25% overall retention rate.

In exchange for the completion of these retrofits, the business will be reimbursed 20% of their overall water fees and charges for the first year. This reimbursement will come at the end of the first fiscal year. This will reduce their first year fees by at least $70,760. The business will enjoy at 20% reduction price per 1,000 gallons of water in subsequent years. While this may seem like a huge financial contribution by the

municipality, it can be made up in the extra taxes collected from persons employed by the business that does not currently exist.

The rational behind the 25% retention rate comes from the previously mentioned retention rate of a well-established rooftop garden retaining 40% of a normal rainfall event. I believe that rooftop gardens will be a popular choice for reducing run-off since many abandoned, industrial buildings have flat roof structures. However, I felt that assuming that a whole roof would be covered for a garden would be extreme. Therefore, I split this retention rate in half and came up with a base of 20%. I did not want the use of rain-gardens to be exclusive so that other technologies were also apply and therefore added an additional 5% retention rate to the base rate of 20%. In order to save some funds for the base contract, I decided that a refund rate of 20% for a 25% reduction in runoff would be appropriate.

Appendix A only shows the 1st contract of the experiment. The second contract changes the financial compensation slightly. It offers the "buyer" a 15% reduction in the price of the property as well as a 10% reduction in its water bill for the first year. Subsequent water bills will still be refunded at 20% as long as the retrofit is maintained, its retention is not degraded, and the "buyer" still maintains an active business at that property. This option would cost the municipality at least $87,880 for the 1st year.

The third contract will increase the reduction rate in the first year water bills to 15% as well as keeping the reduction rate of the price of the property at 15%. This option would cost the municipality $105,570. Under this practice the future water bills would be reduced only 15% per 1,000 gallons used.

Results

I presented the contract to a financial investment advisor who works in the Reading Area for comments. The first contract I used would be the least cost to the municipality and the most for the private business. The plan outlined the payment for an industrial property on N. 11th Street, valued at $350,000. The buyer was informed that they would need to retrofit the property with green stormwater infrastructure at their own cost. They would be provided a list of contractors who are familiar with these types of retrofits for guidance, but it is not required that they utilize these contractors. If they choose not to use the contractors, they need only submit their own plans and techniques for approval to the City of Reading, Department of Public Works. In exchange for the retrofits, proof of 25% rain water retention on the property, and the continued upkeep of the 25% retention for the remainder of the time that the property would be owned by the company, they would receive a 20% refund for their first-year water costs, including hook-ups, as well as a 20% refund for each 1,000 gallons of water they use in subsequent years.

The advisor took the first plan expressing that it was enough of an incentive to be economically viable and attractive to a business. They included that the plan was also attractive in that the business could choose from contractors, but was not required to. This freedom to implement the retrofits by themselves could cost them less as they would be able to find the most economic way to reach the 25% reduction goal, rather than be told they must use certain technologies regardless of their price.

The only issue they had with the contract was the down payment. They indicated that a more realistic down payment would be 20% ($70,000) of the total cost, not half. Overall, they were impressed with the plan in which the municipality would be able to sell the property for its full market value of $350,000 rather than at a reduced cost.

Conclusion

According to the presentation of my contract, a public policy centered around selling abandoned industrial buildings to new businesses by providing economic incentives would be an option for the City of Reading to increase employment and economic growth. In addition, businesses would not be opposed to maintaining the buildings in an ecologically friendly manner as long as it is economically sensible to do so. This policy is able to create a nexus of economic growth, environmentally friendly practices, and urban development, which can foster greater community and aquatic ecosystem stability.

Communities, businesses, human health, and environmental concerns can all be accounted for in local governmental policies. There should not be a trade off of one of these variables for another, but rather all should be accounted for. If this can be accomplished them communities can become safer and more productive as well as sustainable in respect to the needs of future generations. The maintenance of natural resources economic stability is paramount for the continued stability of communities.

Appendix A.

AGREEMENT OF SALE

THIS AGREEMENT OF SALE (this "Agreement") is dated and effective this the 1st day of March, 2015 (the "Effective Date"), and entered into by and between the City of Reading, individual residents of the Commonwealth of Pennsylvania (collectively, the "Seller"), and _____ ("Buyer"), with a principal place of business located at 1830 N. 11th St. Reading, PA 19604 (the "Current Property"). (Seller and Buyer are sometimes hereinafter collectively referred to as the "Parties" and individually referred to as a "Party").

WHEREAS, Seller is the owner of a parcel of real estate commonly known as 1830 N. 11th St. Reading, PA 19604 (the "Property") which is legally described on Exhibit A, attached hereto and incorporated herein by reference.

WHEREAS, for and in consideration of the covenants and agreements herein contained, and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, Seller hereby agrees to sell to Buyer, and Buyer hereby agrees to purchase from Seller, the Property (as defined below) upon and subject to the provisions hereinafter set forth:

ARTICLE 1. DESCRIPTION OF THE PROPERTY

1.1 As used herein, the "Property" shall include the Seller's interest in and to any rights over and across any adjoining the Property and any easements, rights of way or other interests in any Property, highway, street, road or avenue, open or proposed, in, on or across, in front of, abutting or adjoining the Property.

ARTICLE 2. PURCHASE PRICE, EARNEST DEPOSIT AND DOWN PAYMENT

2.1 Purchase Price. The purchase price ("Purchase Price") for the Property shall be the sum of Three-hundred and Fifty Thousand Dollars ($350,000).

2.2 Payment of Purchase Price. The Purchase Price shall be paid as follows:

(a) Buyer, upon execution of this Agreement by all Parties, shall deposit with _____ ("Escrow Agent") the sum of One Thousand Dollars ($1,000.00) as a good faith deposit to purchase the Property (the "Earnest Deposit"). The Earnest Deposit shall be held subject to the provisions of this Agreement and shall be duly accounted for at the Closing of the purchase and sale contemplated herein. The Earnest Deposit shall be applied as a credit against the Purchase Price at the Closing (as defined herein).

(b) At Closing, Buyer shall pay to Seller a the sum of One-hundred and Seventy-Five Thousand Dollars ($175,000), subject to prorations and adjustments as described in Section 2.3 below. This amount shall be paid by wire transfer or other immediately available funds.

(c) The balance of the Purchase Price shall be in the form of a Promissory Note and secured by a Mortgage on the Property, to be executed by the Parties at the Closing, in form and substance as attached hereto as Exhibits B and C respectfully.

2.3 Prorations and Adjustments. At Closing, the parties shall prorate all real estate and ad valorem taxes, assessments and charges on the basis of the calendar year (or fiscal year, as applicable) for which the same are levied, imposed or assessed, regardless of whether the same are due. All tax payments or prorations shall be based on the last ascertainable tax information, including confirmed multipliers. The proration and credit shall be final and binding upon the Parties and no further adjustments shall be made thereto.

2.4 Expenses. Seller shall pay for recording fees for any releases of liens, one-half of any transfer taxes and state or county tax stamps, costs for recording the deed and all of Seller's attorneys' fees. Buyer shall pay for one-half of any transfer taxes and state or county tax stamps, any survey charges incurred by Buyer, if any, any soils investigation fees or other inspection fees, all title insurance search fees and policy premiums, and all of Buyer's attorney's fees. Any other Closing expenses will be paid by the Party that normally incurs such costs and, if both Parties normally incur such costs, such costs shall be split evenly.

ARTICLE 3. CONTINGENCIES

3.1 Title Commitment. Buyer shall obtain a title commitment (the "Commitment") with respect to the Property within thirty (30) days from the Effective Date. Buyer shall deliver a copy thereof to Seller and/or Seller's counsel together with a letter setting forth Buyer's objections to the requirements and exceptions to title listed on Schedule B to the Commitment. Unless Buyer shall object to any such exception, Buyer shall be deemed to have consented to all exceptions to title on Schedule B to the Commitment. Seller shall convey or cause to be conveyed and Buyer shall accept title to the Property subject to: (i) applicable zoning and building ordinances and land use regulations provided they are not currently violated and do not interfere with the use and occupancy of the Property as a food service facility, (ii) such exceptions to title as are listed on Schedule B-II to the Commitment and which are not objected to by Buyer as provided above, and (iii) any exceptions caused by Buyer, its agents, representatives or employees (the foregoing exceptions described in subsections (i) - (iii) being herein collectively called the "Permitted Exceptions").

3.2 Title Defects. Any title exceptions which are objected to by Buyer shall be herein collectively called the "Unacceptable Encumbrances." Seller may elect (but shall not be obligated except as otherwise provided in this Agreement) to remove, or cause to be removed at its expense, any Unacceptable Encumbrances, and shall be entitled to a reasonable adjournment of the Closing (not to exceed thirty (30) days) for the purpose of such removal. Seller shall notify Buyer in writing within five (5) business days (but in any event, prior to the Closing Date) after receipt of Buyer's notice of Unacceptable Encumbrances whether Seller elects to remove the same. Seller shall be deemed to have elected not to remove the applicable item or items if Seller does not so notify Buyer of such election within such five (5) business day period. If Seller is unable, or elects not to remove or endorse over any Unacceptable Encumbrances, or does not remove the Unacceptable Encumbrance to the reasonable satisfaction of Buyer, Buyer may elect, in its sole discretion, as its

sole and exclusive remedy to either (i) to terminate this Agreement and receive return of the Earnest Deposit and within three (3) days of the termination of the same; or (ii) to take such title as Seller can convey without abatement of or credit against the Purchase Price, other than for Monetary Encumbrances (as defined herein). Notwithstanding anything to the contrary contained in this Agreement, and without the need for further notice from Buyer, prior to Closing, Seller shall cure, either by payment or by bond, all Monetary Encumbrances. The phrase "Monetary Encumbrances" as used above means encumbrances or defects to title which by their terms require the payment of money (in an ascertainable amount), whether in installments or at a fixed time or otherwise, in order to remove same (including, by way of example and not limitation, mortgages, real estate taxes, water and sewer charges, assessments, judgments against the Property or mechanics liens). Seller shall deliver to Buyer or the Title Company, at Closing, either (i) instruments in recordable form and sufficient to satisfy such Monetary Encumbrances or other encumbrances of record, together with the cost of recording or filing said instruments or a bond therefor or (ii) other evidence satisfactory to the Title Company pursuant to which the Title Company will be able to insure title without exception for any of the Monetary Encumbrances.

3.3 Title. It shall be a condition to Buyer's obligation to close on the Property (which may be waived in whole or in part by Buyer), that title to the Property shall be good and marketable, free and clear of liens and encumbrances, except the Permitted Exceptions, and insurable at regular rates by a reputable title insurance company selected by Buyer (the "Title Company") in the amount of the Purchase Price, insuring that fee simple title to the Property is vested in Buyer subject only to the Permitted Exceptions.

3.4 Inability to Convey. If Seller is unable to convey title to the Property to Buyer at Closing in accordance with the requirements of this Agreement, Buyer shall have the option of: (a) taking such title as Seller is able to convey; (b) terminating Buyer's obligations under this Agreement and being repaid the Earnest Deposit and any accrued interest thereon within three (3) days of the termination of the same; or (c) extending Closing for a period not in excess of thirty (30) days, during which period Seller shall pay and satisfy all Monetary Encumbrances and correct all other defects, encumbrances and other title objections, and if by such date, Seller has failed to do so, then Buyer shall have the options set forth in (a) and (b) of this Section 3.4.

3.5 Zoning and Land Development. This Agreement is contingent and subject to, Buyer, in Buyer's sole and unfettered discretion, receiving final unappealable permits, variances, and land development approval to operate a _____ (the "Approvals"). At any time prior to the Closing Date, in the event that the Buyer has not received the Approvals, then the Buyer may, prior to the Closing Date, terminate this Agreement and the Earnest Money shall be refunded to the Buyer within three (3) days of termination, and the parties shall have no further obligations to each other hereunder.

3.6 Financing. This Agreement is contingent and subject to the Buyer entering into the Note with the Seller as set forth above. Provided, further, in the event the Buyer is unable to sell the Current Property during the term of the Note, the Buyer shall have the option to extend the Note for an additional six (6) months, upon the same terms and conditions, to permit the Buyer to sell the Current Property. The Note shall contain an acceleration provision requiring the immediate payment of the remaining principal, interest, expenses and costs upon the earlier of the sale and

settlement of the Current Property.

3.7 Due Diligence. Buyer shall have a period of sixty (60) calendar days after the Effective Date (the "Initial Inspection Period") in which to inspect the Property and verify that the Property meets all conditions necessary for its intended use. Seller, upon twenty-four (24) hours prior notice, shall provide Buyer, its contractors and representatives, with complete and full access to the Property to conduct its inspection of the Property. At any time during the Initial Inspection Period, as may be extended pursuant to Section 3.8 below, Buyer, in its sole discretion, may terminate this Agreement by providing Seller with written notice of termination prior to the expiration of the Initial Inspection Period. Upon any such termination in accordance with this Agreement, Buyer shall be entitled to a full refund of the Earnest Deposit within three (3) days of termination. Except as otherwise expressly set forth herein, in the event that Buyer does not terminate this Agreement within the Initial Inspection Period, Buyer shall be deemed to be satisfied with the Property and Buyer's right to terminate shall terminate after the expiration of the Initial Inspection Period, unless otherwise extended as set forth in 3.8 below.

3.7 Extension of Due Diligence Period. Buyer shall have the right to extend the Initial Inspection Period in its sole and unfettered discretion by providing Seller with written notice prior to the expiration of the Initial Inspection Period for an additional thirty (30) days (the "Extension Period") to complete it due diligence as set forth in section 3.6 above. Except as otherwise expressly set forth herein, in the event that Buyer elects to terminate the Agreement on or before the expiration of the Extension Period, for any reason, the Earnest Deposit shall be refunded to the Buyer within three (3) days of the date of termination, and the Parties shall have no further obligation to each other under this Agreement. In the event the Phase I Environmental Report on the Property demands the need for a Phase II Environmental Report, the Extension Period shall be extended to allow for the completion of the Phase II Environmental Report. If the Phase II Environmental Report depicts an unfavorable environmental condition for the Property, the Buyer may terminate this Agreement and the Earnest Money shall be refunded to the Buyer and the parties shall have no further obligations to each other.

ARTICLE 4. REPRESENTATIONS AND WARRANTIES

4.1 Seller's Representations and Warranties. Seller, to induce Buyer to enter into this Agreement and to complete Closing, makes the following representations and warranties to Buyer, which representations and warranties are true and correct as of the Effective Date, and shall be true and correct at and as of the date of Closing in all respects as though such representations and warranties were made both at and as of the Effective Date and at and as of the Closing Date:

(a) There are no options, rights of first refusal, or any other agreements affecting Seller's right to complete this sale;

(b) Seller has full legal right, power and authority to enter into and perform its obligations under this Agreement and under the other agreements, instruments, deed and documents (the "Seller Transaction Documents") required to be delivered by it prior to or at the Closing. This Agreement has been duly and validly executed and delivered by Seller and constitutes the legal, valid and binding obligation of Seller enforceable against it in accordance

with its terms. When executed and delivered as contemplated herein, each of the Seller Transaction Documents shall constitute the legal, valid and binding obligation of Seller, enforceable against it in accordance with its terms; except as such enforceability may be limited by bankruptcy, insolvency, reorganization, moratorium or other similar laws affecting creditors' rights generally and by the availability of equitable remedies;

(c) The execution and delivery of this Agreement and compliance with its terms will not conflict with or result in the breach of any law, judgment, order, writ, injunction, decree, rule or regulation, or conflict with or result in the breach of any other agreement, document or instrument to which Seller is a party or by which it or the Property is bound or affected;

(d) Seller has not been notified of any violations or non-compliance with applicable federal, state and local environmental regulations regarding the Property and, to the best of Seller's knowledge, Seller has complied with all applicable federal, state and local environmental regulations regarding the Property. There are no suits, actions or proceedings pending, or, to the best of Seller's knowledge, threatened against Seller in connection with the Property; and

(e) There are no claims, actions, suits or proceedings pending or, to the best of Seller's knowledge, threatened against or affecting the Seller or the Property, at law or in equity, or before or by any federal, state, municipal or other governmental agency or instrumentality, domestic or foreign, or before any arbitrator of any kind wherever located, which would inhibit or prevent Seller from fulfilling its obligations hereunder; and to the best of Seller's knowledge, the Seller is not in default under any law or regulation or with respect to any judgment, order, writ, injunction, decree, award, rule or regulation of any court, arbitrator or federal, state, municipal or other governmental agency or any instrumentality.

(f) To the best of Seller's knowledge: (a) there are no Hazardous Substances or underground storage tanks in, on or under the Property; (b) there are no past, present or threatened Releases of Hazardous Substances in, on under or from the Property; (c) there is no threat of any Release of Hazardous Substances migrating to the Property; (d) there is no past or present non-compliance with any Environmental Laws, or with permits issued pursuant thereto, in connection with the Property; (e) Seller does not know of, and have not received, any written or oral notice or other communication from any persons or entity, including, but not limited to a governmental entity, relating to Hazardous Substances or remediation thereof, or possible liability of any person or entity pursuant to any Environmental Law, other environmental conditions in connection with the Property, or any actual or potential administrative or judicial proceedings in connection with any of the foregoing; and (f) Seller has provided to Buyer, any reports in Seller's possession relating to Hazardous Substances in relation to the Property.

"Hazardous Substances" shall mean and include asbestos, flammable materials, explosives, radioactive substances, polychlorinated biphenyls (PCB's), other carcinogens, oil and other petroleum products, pollutants or contaminants that are detrimental to the environment, and any other hazardous or toxic materials, wastes, and substances which are defined, determined, or identified as such under CERCLA, RCRA, or any other applicable present or future federal, state or local laws, rules, codes or regulations or any judicial or administrative interpretation thereof;

"Environmental Laws " shall mean all present and future federal, state or local laws, rules, codes or regulations, or any judicial or administrative interpretation thereof, including, without limitation, all orders, decrees, judgments and rulings imposed through any public or private enforcement proceedings relating to Hazardous Materials or the existence, use, discharge, release, containment, transportation, or disposal thereof;

(g) From and after the Effective Date and for so long as this Agreement is in full force and effect, Seller shall not convey any portion of the Property or any rights therein, or enter into any conveyance, security document, easement or other agreement, or amend any existing agreement, granting to any person or entity any rights with respect to the Property or any part thereof or any interest whatsoever therein, without Buyer's prior written consent.

(h) Seller may have knowledge of any pending or threatened condemnation or similar proceeding affecting the Property or any portion thereof, or pending public improvements in, about or outside the Property which will in any manner affect access to the Property. Such improvements will be made clear to the Buyer, and will require the Buyer to make such improvements in absence of pending public improvements.

(i) There are no service contracts, broker agreements and other contracts affecting the Property which will be binding upon Buyer after the Closing except for those included in the Permitted Exceptions or as otherwise identified in Exhibit D attached hereto.

(j) Seller is not a "foreign person" as that term is defined in the Federal Foreign Investment in Real Property Tax Act of 1980 or the 1984 Tax Reform Act, as amended.

(k) No petition in bankruptcy (voluntary or otherwise), assignment for the benefit of creditors, or petition seeking reorganization or arrangement or other action under federal or state bankruptcy laws has been filed or commenced or is pending against Seller or the Property.

(l) Neither Seller nor any person or entity owning (directly or indirectly) a ten percent (10%) or greater ownership interest in Seller: (i) is now or shall become, a person or entity with whom Buyer is restricted from doing business with under the regulations of the Office of Foreign Assets Control ("OFAC") of the Department of the Treasury (including, but not limited to, those names on OFAC's Specially Designated Nationals and Blocked Person list) or under any statute, executive order (including, but not limited to, the September 24, 2001, Executive Order Blocking Property and Prohibiting Transactions With Persons Who Commit, Threaten to Commit, or Support Terrorism), or other governmental action; (ii) is now or shall become, a person or entity with whom Buyer is restricted from doing business with under the International Money Laundering Abatement and Financial Anti-Terrorism Act of 2001, or the regulations or orders thereunder; and (iii) is not knowingly engaged in, and shall not engage in, any dealings or transactions, or be otherwise associated with such persons or entities described in (i) and (ii) above.

4.2 Seller's Covenants. Seller and Buyer agree that the representations and warranties of Seller set forth herein and elsewhere in this Agreement shall not survive the Closing, it being expressly understood that only those representations and warranties contained in the Seller Transaction Documents delivered at the Closing shall survive the Closing. Seller shall not knowingly take or cause to be taken any action, or fail to perform any obligation, which would

cause any of the foregoing representations or warranties to be materially untrue as of Closing. Seller shall immediately notify Buyer, in writing, of any event or condition known to Seller that occurs prior to Closing hereunder, which causes a change in the facts relating to, or the truth of, any of the above representations or warranties.

4.3 AS-IS CONDITION. EXCEPT AS OTHERWISE SET FORTH HEREIN, BUYER ACKNOWLEDGES AND AGREES THAT THE BUYER IS PURCHASING THE PROPERTY IN AS-IS, WHERE-IS CONDITION.

4.4 Permits and Variances. Buyer represents and warrants that Buyer shall diligently pursue all necessary permits or variances from the appropriate governmental entities that are necessary in connection with the proposed use of the Property.

ARTICLE 5. CLOSING

5.1 Place and Closing Date. The closing of the purchase and sale of the Property (the "Closing") pursuant to this Agreement shall take place on the date that is thirty (30) days after the date upon which Buyer obtains all of the Approvals, unless otherwise extended in writing executed by both Parties (the "Closing Date"). Closing shall take place at the offices of the Title Company, or at such other place as may be agreed to by Buyer and Seller.

5.2 Possession. At Closing, Seller shall deliver actual and sole possession of the Property, free and clear of all liens and encumbrances, other than the Permitted Encumbrances to the Buyer. Prior to Closing, Seller shall have removed all personal property from the Property.

5.3 Special Assessments. Seller shall pay any special assessments affecting the Property which were assessed on or prior to the Closing Date.

5.4 Conditions Precedent to Closing. Notwithstanding anything herein to the contrary, Seller shall deliver to Buyer at Closing, all of the following, duly executed, the delivery of which shall be a condition to Buyer's obligation to consummate the purchase of the Property:

(a) A Special Warranty Deed from Seller conveying fee simple title to the Property free and clear of all liens, encumbrances, easements and restrictions of every nature and description, except the Permitted Exceptions.

(b) Affidavit of Non-Foreign Status in the form required by the Internal Revenue Service.

(c) Such other documents, instruments and items as may reasonably be required to consummate the transactions contemplated by this Agreement.

5.5 Buyer's Obligations at Closing. At Closing, Buyer shall provide to Seller, in addition to any other obligations of Buyer as set forth in this Agreement:

(a) The balance of the Purchase Price to Seller as required under Section 2.2(b) (subject to adjustments and prorations as set forth herein).

(b) Promissory Note, fully executed;

(c) Mortgage, fully executed; and

(d) Such other documents, instruments and items as may reasonably be required to consummate the transactions contemplated by this Agreement.

ARTICLE 6. NOTICES

6.1 Notice. Any notice, request, approval, demand, instruction or other communication to be given to either Party hereunder, unless specifically stated otherwise herein, shall be in writing, and, except those required to be delivered at Closing, shall be conclusively deemed to be delivered when personally delivered or when deposited in the U.S. mail, sent either by certified mail, return receipt requested, by overnight courier or by telecopy, but in all cases addressed to the parties as follows:

If to Seller: _____
_____
_____

If to Buyer: _____
_____
_____

The date of notice, in the case of notice given by any means other than certified mail, return receipt requested, shall be the date of receipt by the Party receiving such notice, and the date of notice in the event of notice sent certified mail, return receipt requested, shall be the date of depositing same in the mail as evidenced by the postmark thereon.

6.2 Change of Address. The addresses of the Parties for purposes of notice may be changed by giving notice of such change thereof to the other Party. Unless and until such written notice is received, the last address and addressee stated herein shall be deemed to continue in effect for all purposes.

ARTICLE 7. DEFAULTS AND REMEDIES

7.1 Seller's Default. If Seller fails to perform any of Seller's obligations hereunder for any reason other than the termination of this Agreement by Seller or Buyer pursuant to any right to terminate expressly set forth in this Agreement, or Buyer's failure to perform Buyer's obligations under this Agreement, or if any of Seller's representations or warranties set forth in this Agreement, are determined to be materially inaccurate or untrue then Buyer, at Buyer's option, shall have the right to either: (a) terminate this Agreement by giving written notice thereof to Seller, whereupon the Earnest Deposit, if any, shall be refunded to Buyer free and clear of all rights and claims with respect thereto by Seller, and thereafter neither Buyer nor Seller shall have any further rights or obligations hereunder; or (b) seek specific performance of this Agreement.

7.2 Buyer's Default. If Buyer fails to perform any of Buyer's obligations hereunder for any reason other than (a) the termination of this Agreement by Seller or Buyer pursuant to any right to terminate expressly set forth in this Agreement, or (b) Seller's failure to perform Seller's obligations under this Agreement, then Seller shall have the right to terminate this Agreement by giving written notice thereof to Buyer and retain the Earnest Deposit as liquidated damages and neither Buyer nor Seller shall have any further rights or obligations under this Agreement.

ARTICLE 8. MISCELLANEOUS

8.1 Binding Effect. Subject to the provisions of Section 8.9, this Agreement is binding upon and inures to the benefit of the Parties, their successors and assigns.

8.2 Entire Agreement. This Agreement constitutes the entire agreement between the Parties, and there are no other covenants, agreements, promises, terms and provisions, conditions, undertakings or understandings either oral or written, between them concerning the Property other than those herein set forth. No subsequent alteration, amendment, change, deletion or addition to this Agreement shall be binding upon Seller or Buyer unless in writing and signed by the Parties. This Agreement amends and restates any previous contract entered into by the Parties on the subject matter hereof.

8.3 Exhibits. Any reference herein to any exhibits, addenda or attachments refers to the applicable exhibit, addendum or attachment that is attached to this Agreement, and all such exhibits, addenda or attachments shall constitute a part of this Agreement and are expressly made a part hereof.

8.4 Captions. The captions in this Agreement are inserted only as a matter of convenience and for reference and in no way define, limit or describe the scope of this Agreement or the scope or content of any of its provisions.

8.5 Waiver; Modification. Failure by either Party to insist upon or enforce any of their respective rights hereunder shall not constitute a waiver thereof, except as provided herein.

8.6 Counterparts. To facilitate execution, this Agreement may be executed in as many counterparts as may be required and it shall not be necessary that the signature of, or on behalf of, each Party, or that the signatures of the persons required to bind any Party, appear on more than one counterpart. All counterparts shall collectively constitute a single agreement.

8.7 Time of Essence. Except as otherwise provided in this Agreement, time is of the essence of this Agreement.

8.8 Brokers. Buyer and Seller each represent to the other that there are no real estate agents or brokers entitled to a commission in connection with this purchase and sale of the Property If any claim is made or brought by any broker or agent in connection with this transaction, the party whose agreement or action gave rise to such claim shall indemnify the other for any damage

or expenses sustained in connection therewith including, without limitation, reasonable attorney's fees.

8.9 Assignment. Buyer shall not assign its rights under this Agreement without the prior written consent of the Seller, which consent shall not be unreasonably withheld.

8.10 Indemnity. Seller shall indemnify and hold Buyer harmless from and against any and all claims, liabilities, losses, damages, causes of action and expenses (including court costs and reasonable attorney's fees related thereto) arising out of, in connection with or resulting from the use, occupancy or operation of the Property up to and including the Closing, including any such matters arising out of the violation of any environmental law, rule or regulation. Buyer shall indemnify and hold Seller harmless from and against any and all claims, liabilities, losses, damages, causes of action and expenses (including court costs and reasonable attorney's fees related thereto) arising out of, in connection with or resulting from Buyer's investigation of the Property or the Buyer's use, occupancy or operation of the Property from and after Closing, including any such matters arising out of the violation of any environmental law, rule or regulation. This Section 8.10 shall survive Closing.

8.11 Attorneys Fees. If any action or suit shall be brought by either Party against the other to enforce the provisions of this Agreement, the prevailing Party shall be entitled to recover from the other Party such attorney's fees and costs as the court shall determine to be reasonable.

8.12 Governing Law; Jurisdiction; Venue. This Agreement shall be governed by the laws of the Commonwealth of Pennsylvania. The Parties covenant and agree that any dispute or controversy hereunder properly belongs within the jurisdiction of the state or federal courts of Pennsylvania, and consent and agree that Berks County, Pennsylvania is a convenient and proper venue.

8.13 Arbitration. Any disputes arising out of this Agreement shall be resolved pursuant to the then-operating arbitration rules of the Berks County, Pennsylvania Bar Association. Either Party may enter any award resulting therefrom as a judgment in any court of competent jurisdiction. All arbitration proceedings shall be held in Berks County, Pennsylvania.

{Signatures on Following Page}

IN WITNESS WHEREOF, this Agreement has been executed as of the date first written above.

SELLER:

_____

BUYER:

_____

By: _____
_____, President

EXHIBIT "A"
SERVICE CONTRACTS

The "Buyer" is subject to enter into this agreement under the condition that the parcel and property be maintained pursuant to techniques and requirements outlined by the city. These requirements include approved green stormwater runoff techniques to reduce impermeable surfaces contained within the property and parcel. The techniques, upon completion, are subject to inspection by the City of Reading Department of Public Works. Monitoring reports are to be compiled by the "Buyer" and submitted to the Department for approval on a continuous 6-month basis.

The "Buyer" is tasked with implementing the following list of approved techniques on the property and parcel, defined as "retrofits," in order to be covered under the *Clean, Working Cities* program. This list is not exhaustive, and if the "Buyer" wishes to implement a different technique they must first obtain approval from the Department. Possible techniques include:

a. Rooftop Gardens
b. Rain Barrels
c. Pervious Pavement
d. Rain Garden (pursuant to zoning)
e. Flow-through Planters
f. Stormwater Trench (pursuant to zoning)
g. Stormwater Tree Trench (pursuant to zoning)
h. Stormwater Bumpout (pursuant to zoning)
i. Stormwater Planter (pursuant to zoning)

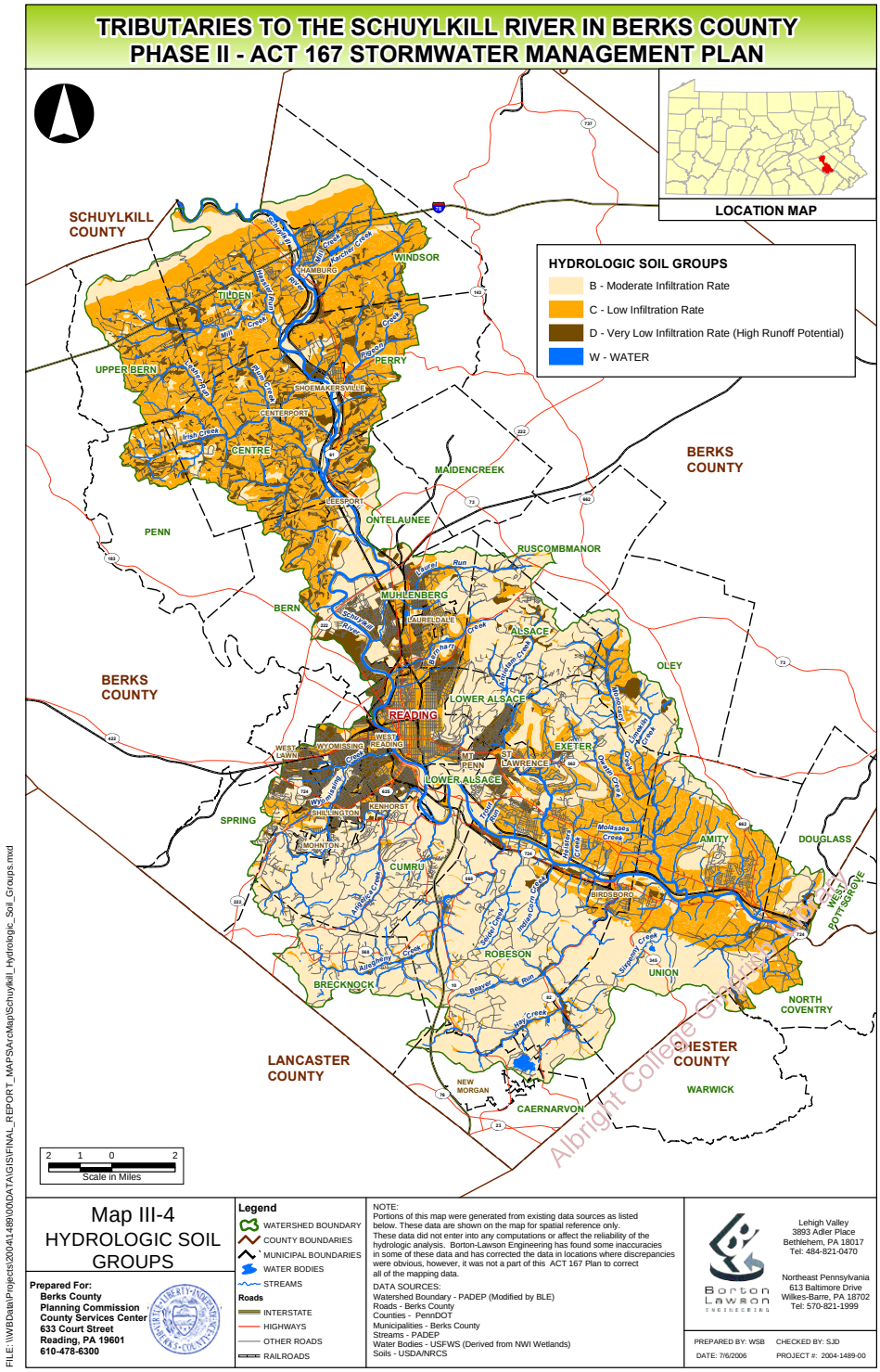
The "Buyer" is responsible for accruing costs for these retrofits. A list of city contractors will be available to the "Buyer." These contractors are familiar with these types of Green Infrastructures. The "Buyer" is not constricted to the use of these or any other contractors in its implementation of retrofits. It is the personal decision of the "Buyer" as to which technologies to use in order to meet the standards set out below. It is the responsibility of the "Buyer" to prepare and submit the proposed retrofit plan to the Department within six months of the property purchase.

The "Buyer" must retain 25% of rainfall on-site. The runoff of each site prior to retrofits will be calculated by utilizing the current impermeable surface square footage of the site. The percentage of retention for each technology will be calculated based on the gallons of retention possible for each technology per 2-year rainfall event (3.19 inches)*. The overall retention rate (addition of all retention rates of all green stormwater technologies on site) must be at least 25% of a 2-year event (3.19 inches).

In exchange for these retrofits, the "Byers" first year water bill, including hook-up and fees, will be reduced by 20%. This reduction will be refunded to the "Buyer" at the end of the first fiscal year. In addition, the "Buyers" water usage bill will be reduced by 20% per 1,000 gallons of water used for each subsequent year that they remain in business in the City of Reading and continue to upkeep their retrofits to meet its original capacity for retention.

*2-year rainfall events for Reading calculated from NOAA's National Weather Service (http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=pa).

Appendix B



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