GREEN ROOFS

Inder Deep Paul

I. **Introduction**:

A green roof is an extension of the existing roof which involves a high quality water proofing and root repellant system, a drainage system, filter cloth, and a lightweight growing medium.[1] There are certain kinds of green roofs that also include plants.[2] Green roof development involves the creation of "contained" green space on top of a man-made structure. This green space could be below, at or above grade, but in all cases the plants are not planted in the "ground."[3] Depending upon the ultimate goal, green roofs may be of various kinds: (1) extensive green roof, which generally requires no irrigation, (2) biodiverse roof, which is typically a non-vegetated roof and includes a brown roof, (3) semi-intensive green roof, which may have characteristics of both extensive and biodiverse roofs thereby permitting plantation of a wider range of plants, and (4) intensive green roof, which is generally referred to as roof garden and provides benefits akin to a small urban park or domestic garden.[4] Intensive green roofs are more familiar in United States, and are primarily intended to achieve aesthetic and architectural objectives.[5]

This paper will illuminate the following points: (1) green roofing practices that help tackle the existing stormwater runoff problem, (2) the lack of effective legislation regarding green roof installation, (3) green roof laws in other jurisdictions, and (4) the monetary realities of green roofs in upcoming developments. A proposed model ordinance is attached.

---

[1] Green Roof for health cities, (2014), http://www.greenroofs.org/index.php/about/aboutgreenroofs
[2] Id.
[3] Id.
[4] The GRO Green Roof Code, Green Roof Code of Best Practice for the UK, (2011), http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=GRO_Green_Roof_Code.pdf
[5] Pennsylvania Stormwater Best Management Practices Manual, December 30, 2006, Chapter 6, at 125.

Finally, this narrative and the ordinance that follows, track the thesis that the power to transform our society from "unhealthy, stressful, overheated environments to healthier, more sustainable communities is completely within our reach" – and green roofs are one of the many mechanisms that can help us achieve that transformation within a generation.[6]

II. **Stormwater runoff problem**:

A major problem we face is stormwater runoff. A green roof is effective in reducing the volume and velocity of stormwater runoff from roofs by temporarily storing stormwater, slowing excess stormwater release into the combined sewer system, and promoting evapotranspiration.[7] The vegetated features of green roofs manage rain where it hits the ground similar to the way a natural system such as a forest or a meadow would handle rain runoff.[8] This illustrates the efficacy of using nature's own designs in which rainwater is an essential component for a thriving ecosystem. Direct runoff from roofs is often a contributor to non-point source[9] (NPS) pollutant discharges. Once a green roof is installed, experience indicates it will take five or more years for water quality vegetated cover to attain its maximum potential pollutant removal efficiency.[10] Further, once the total impervious area is

[6] Jim Van Spengen, The effects of large-scale green roof implementation on rainfall-runoff in tropical urbanized subcatchment, A Singapore case study (October, 2010), http://www.citg.tudelft.nl/fileadmin/Faculteit/CiTG/Over_de_faculteit/Afdelingen/Afdeling_watermanagement/Sections/waterhuishouding/Leerstoelen/Waterbeheer/onderzoek/Projects/Msc_Research/Completed/000_Spengen,_J._van/doc/MSc_thesis_Jim_van_Spengen_SN1158007.pdf

[7] Philadelphia Water Department, Green Stormwater Infrastructure Tools, (2015), http://phillywatersheds.org/what_were_doing/green_infrastructure/tools; Evapotranspiration is the loss of water from the soil both by evaporation from the surface and by transpiration from the plans growing thereon. Webster's Third New International Dictionary.

[8] Green City Clean Waters, The City of Philadelphia's Program for Combined Sewer Overflow Control Program, (June 1, 2011), http://www.phillywatersheds.org/doc/GCCW_AmendedJune2011_LOWRES-web.pdf.

[9] The US Environmental Protection Agency defines NPS as pollution, unlike pollution from industrial and sewage treatment plants, that comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters. *See* Polluted Runoff, Nonpoint Source Pollution, http://water.epa.gov/polwaste/nps/index.cfm (last updated Feb. 25, 2015)

[10] Pennsylvania Stormwater Best Management Practices Manual, December 30, 2006, Chapter 6, at 125.

determined,[11] a simple formula may be employed to calculate the volume of stormwater runoff that must be controlled.[12]

Another major concern green roofs may address is the excessive heat in buildings during summer months. Green roofs reduce the severity of extreme heat events in three ways—by creating shade, by reducing the amount of heat absorbed by rooftops, and by emitting water vapor—all of which cool hot air.[13]

III. **Why a green roof ordinance is needed**:

The existing laws typically address stormwater runoff issues but do not mandate or recommend green roofs to tackle such runoff. Instead, ordinances specifically assume roofs as impervious and merely calculate runoff rate.[14] Thus, although there are no existing laws barring green roof installation, there is clearly a dearth of laws incentivizing or mandating their installation. Some ordinances mention green roofs as one of the best management practices (BMP's), yet fail to explain effective implementation.[15] The best that ordinances have provided so far, is a tax credit for successful installation of green roofs, and a minor credit towards the green building permit fee.[16] Thus, we need new laws that expand the

[11] Each municipality has its respective ordinance that provides for calculation of the gross floor area. When calculating the total impervious area, individuals may follow the same formula, but restrict themselves to impervious areas of the building or structure.
[12] Small Project Stormwater Management Control Guidance, http://www.northamptontownship.com/media/6154/Small-Project-Stormwater-Management-Control-Guidance.pdf
[13] Id.; *See* Urban Redevelopment Authority of Pittsburgh, Green Development Resources for Commercial Development, (2010), http://www.ura.org/pdfs/Green-Development-Resource-Guide-Commercial.pdf.
[14] Borough of Clarks Green, Ord. 2-2014, 3/19/2014, § 26-124 A (1) (a); S*ee* http://www.keystatepub.com/keystate-pdf/PA/Lackawanna/Clarks%20Green%20Borough/Chapter%2026%20Water.pdf; Borough of Ben Avon, Ord. 709, 11/18/2003, § 23-201 C (defining, among other things, "any roof" to be an impervious surface); S*ee generally* East McKeesport Stormwater Management Ordinance, Ord. 834, 2/24/2004 § 26-111 C.
[15] Township of West Lebanon, Ord. 447, 1/2/2007, App. B; see http://www.keystatepub.com/keystate-pdf/PA/Lebanon/West%20Lebanon%20Township/Chapter%2023%20Stormwater%20Management.pdf
[16] City of Chicago, Green Permits, (2010-15), www..orcityofchicagog/city/en/depts/bldgs/provdrs/green_permit.html

existing incentives and encourage large scale installation of green roofs, at least in the commercial sector.

Changing roof structure from simple impervious roofs to green roofs will lead to benefits in all spheres, including social, environmental, and economic benefits. In an era where we emphasize integrated decision making, we must look at these benefits as interrelated rather than independent of one another. First, green roofs will lead to higher property values due to longer durability. Essentially, the membrane of plants on the roof will protect the roof from thermal stress induced by UV rays, thereby increasing life of the building.[17] Consequently, the energy cost of such buildings will decrease due to insulating effect of the planting and drainage layer.[18]

Second, higher property values lead to increased revenue for local government. This increased revenue will help local government to increase greening efforts, as well as enhanced awareness of effectiveness of green roofs in tackling stormwater runoff.[19] This will further increase green roof demands by commercial building owners, thereby creating jobs for landscapers, and engineers to install and maintain green roofs.[20] Specifically, since green roof installation requires environmental engineers to play a pivotal role in the entire installation and maintenance process, job opportunities for environmental engineers will increase in each municipality.

[17]The GRO Green Roof Code, Green Roof Code of Best Practice for the UK, (2011), http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=GRO_Green_Roof_Code.pdf
[18]Id.
[19] Green City Clean Waters, The City of Philadelphia's Program for Combined Sewer Overflow Control Program, (June 1, 2011), http://www.phillywatersheds.org/doc/GCCW_AmendedJune2011_LOWRES-web.pdf.
[20] Id.; *See generally* The GRO Green Roof Code, Green Roof Code of Best Practice for the UK, (2011), http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=GRO_Green_Roof_Code.pdf

In addition to environmental and economic functions, green roofs serve recreational open spaces. The open lawn design gives them a look of a family park, and families can undertake recreational activities without ever realizing they are on a green roof.[21]

Further, green roofs lead to increased biodiversity. Intensive green roofs on new buildings, with soil deep enough for carefully selected native species, offer the opportunity to restore at least a part of lost flora.[22] As green roofs gain popularity, local government is permitted to give a tax credit to those building owners or users who install green roof tops. This essentially will have two consequences. First, the existing business entities that have not yet installed a green roofs will consider green roof installations to receive the tax credit and second, new business entities will consider establishing their ventures with green roof tops to avail themselves of the tax credits.[23] Thus, the initiation of green roofing efforts are targeted towards commercial building owners or users who meet the specific requirements of the ordinance.

IV. **Green roofs in other jurisdictions**:

The city of Cambridge, Massachusetts provides for green roof installation through its local zoning ordinance.[24] First, the ordinance defines a functional green roof area as a rooftop, surfaced with soil and living plant materials.[25] Thereafter, the ordinance clarifies that provisions of the ordinance are applicable to projects no less than 25,000 square feet –

[21] *See* James Shields, *Roofing Best Practices*, (2015), http://facilitymanagement.com/articles/green1-1011.html.
[22] *See* Id.
[23] *See generally* Green City Clean Waters, The City of Philadelphia's Program for Combined Sewer Overflow Control Program, (June 1, 2011), http://www.phillywatersheds.org/doc/GCCW_AmendedJune2011_LOWRES-web.pdf.
[24] Zoning Ordinance, Cambridge, Massachusetts, (January, 2015), file:///C:/Users/InderDeep/Downloads/zo_article22_1363.pdf
[25] Id.

that is, commercial buildings in the zoning district.[26] Finally, the ordinance provides for application requirements, special permit requirements, and Leadership in Energy and Environmental Design (LEED) certification.[27] As an incentive for building owners, green roofs are excluded from calculation of the gross floor area, even when access to the rooftop is provided.[28] As a result of the ordinance, various private companies that install green rooftops have experienced business growth due to increased demands of green roofs by local commercial building owners.

Another city that encourages installation of green roofs is Chicago. It promotes building design, construction and renovation in a manner that provides healthier environments, reduces operating costs and conserves energy.[29] The Department of Buildings offers two programs for projects that include green elements: (1) the Green Permit Benefit Tier Program, and (2) the Green Permit Program.[30] The former offers qualifying projects an expedited permit process and possible reduction of permit fees whereas the latter offers projects with green elements (geothermal systems, green roofs, photovoltaic systems, rainwater harvesting systems, solar thermal panels and wind turbines) a priority review process.[31] Furthermore, building owners who apply for a green permit receive a credit in the amount of five cents per square foot towards their permit fee.[32] Chicago's most famous rooftop garden sits atop City Hall, an 11-story office building. Established in the year 2000, the garden consists of 20,000 plants of more than 150 species, including shrubs, vines and

[26] Id.
[27] Id.
[28] Community Development Department, City of Cambridge, Massachusetts, (2011), http://www.cambridgema.gov/cdd/projects/planning/greenbuildings
[29] City of Chicago, Green Permits, (2010-15), www..orcityofchicagog/city/en/depts/bldgs/provdrs/green_permit.html
[30] Id.
[31] Id.
[32] City of Chicago, Department of Buildings, Green Permit Program-Project Submittal Checklist, http://www.cityofchicago.org/content/dam/city/depts/bldgs/general/GreenPermit/Green_Roof_Checklistada.pdf

two trees.[33] The plants were selected for their ability to thrive in the conditions on the roof, which is exposed to the sun and can be windy, arid, and most are prairie plants native to the Chicago region.[34] Additionally, the rooftop garden absorbs less heat from the sun than the tar roof, keeping City Hall cooler in the summer and requiring less energy for air conditioning.[35] The city also calculated the rooftop garden's ability to retain seventy-five percent of one inch rainfall before there is any stormwater runoff into the sewers.[36]

Green roofing has been gaining popularity in other jurisdictions as well. One of the completed projects is in Washington DC. The Departmental Management (DM) operations staff and other Untied States Department of Agriculture (USDA) agencies worked to implement "multifunctional beneficial landscaping" on the grounds of USDA headquarters.[37] In fall 2010, the People's Garden Team completed the installation of 3500 square foot green roof in the Southern building of the USDA headquarters, along with installation of a 500 gallon cistern to capture runoff water.[38] This installation gives the USDA headquarters a colorful and lively scenery, thereby adding aesthetic value while serving the environmental function.

While the USDA headquarters installed a green roof instead of the regular impervious roof, the ultimate weight of the green roof is the same when wet. Thus, the building did not require structural modifications. The green roof acts like a giant bio-filtration sponge soaking up stormwater and reducing runoff which is one of the most serious problems facing local

---

[33] *See* Fleet and Facility Management, City Hall's Rooftop Garden, http://www.cityofchicago.org/city/en/depts/dgs/supp_info/city_hall_green_roof.html.
[34] Id.
[35] Id.
[36] Id. *See also* Water Management, Green Roofs: Best Management Practices, http://www.cityofchicago.org/city/en/depts/water/supp_info/conservation/green_design/green_roofs_bestmanagementpractices.html.
[37] Court 5 Green Roof, http://www.dm.usda.gov/HQs_GreenTeam/WriteUpCourt5GreenRoof.pdf.
[38] Id.

waterways and the Chesapeake Bay.[39] Finally, the USDA intended the green roof to be an example for Federal Agencies and public regarding beneficial landscaping practices—thereby making USDA headquarters a Sustainable Sites Initiative (SITES) pilot location.[40]

In Pennsylvania, the city of Philadelphia attained substantial green roofs through implementing a program for combined sewer overflow control. In 2008, Parkway Central Library's green roof demonstration project atop the four-story building was initiated.[41] The green roof encompasses 5,000 square feet, is protected by an ethylene propylene diene monomer (EPDM)[42] waterproofing membrane, and includes more than 5,400 plants.[43] The green roof top is the first green roof on a city-owned building, and is accessible to the public giving a scenic view of central Philadelphia.[44] The roof is an "extensive" design, with some semi-intensive areas. This means the roof does not require irrigation for the most part. In addition to preventing stormwater runoff, the green roof helped the library air conditioning system because the average recorded temperatures after installation of the green roof were thirty to forty degrees lesser than areas not covered by green roofs.[45] Although there is no ordinance that encourages green roofs specifically, Philadelphia offers a green roof tax credit to business owners constructing an addition to their roof that supports living vegetation and

[39] *See* Id.
[40] Id.
[41] *See* Green City Clean Waters, The City of Philadelphia's Program for Combined Sewer Overflow Control Program, (June 1, 2011), http://www.phillywatersheds.org/doc/GCCW_AmendedJune2011_LOWRES-web.pdf.
[42] The EPDM Roofing Association defines EPDM as "an extremely durable synthetic rubber roofing membrane widely used in low-slope buildings." *See* EPDM Roofing Association, What is EPDM, http://www.epdmroofs.org/what-is-epdm.
[43] Id.; *See* Free Library of Philadelphia, Parkway Central, (2008), http://www.greenroofs.com/projects/pview.php?id=1383.
[44] Id.
[45] Id.; S*ee also* Green City Clean Waters, The City of Philadelphia's Program for Combined Sewer Overflow Control Program, (June 1, 2011), http://www.phillywatersheds.org/doc/GCCW_AmendedJune2011_LOWRES-web.pdf.

includes a synthetic, high quality water proof membrane.[46] Further, the same tax credit incentive provides for approval and denial criteria to obtain the tax credit, as well as the timing and procedure of green roof installation.[47]

V. **Key policy issues:**

Having identified the green roofing benefits, and the lack of specific legislation mandating or incentivizing their installation, we must also consider policy concerns of decision makers while proposing, adopting and implementing green roof legislation.

First, the decision makers must address the cost of green roofing. Green roof installation requires waterproofing that is resistant to biological and root attack. In many instances, a supplemental root-fast layer will be installed to protect the primary waterproofing membrane from plan roots.[48] This process is extremely labor intensive, and if not done properly in the first instance, the remedial costs can be significant.[49] An additional monetary challenge is raising the substrate to the roof level and its subsequent dispersion across the roof.[50] Each project needs to be assessed for cost on own its specific conditions like roof area, slope, structure, accessibility and so on. Furthermore, other factors that influence cost of green roofs include: (1) accessibility of the structure by large equipment such as cranes and trailers, (2) depth and complexity of the assembly, (3) remoteness of the project from sources of material supply, and (4) the overall size of the project.[51] Depending on market factors, green roof

[46] Philadelphia public-private economic development corporation, Green Roof Tax Credit, http://philadelphiaretail.com/pdf/GreenRoofTaxCredit.pdf
[47] Id.
[48] Pennsylvania Stormwater Best Management Practices Manual, December 30, 2006 at 125.
[49] *See* The GRO Green Roof Code, Green Roof Code of Best Practice for the UK, (2011), http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=GRO_Green_Roof_Code.pdf.
[50] Id.
[51] Dunnett, N & Kingsbury, N, Planting Green Roofs and Living Walls, (Timber Press, 2004).

costs will typically range between $8 and $15 per square foot. Basic maintenance for green roofs generally requires three man-hours per 1,000 square feet annually.[52]

Second, it is important that decision makers outline the construction process. This serves two underlying purposes. One, it assures that if the process is followed, it will save later expenditure on remedial measures, and two, it will give the engineers and landscapers a starting point in establishing green roofs. Laying out the construction sequence will also suggest the economic reality of green roofs to potential entities seeking their installation. Although the construction sequence may vary depending upon the size and location of the project, the decision makers should generally be aware of the following points:

1- Visual inspection of the completed waterproofing to identify any patent defects. The waterproofing must be tested for water tightness by the roofing applicator.

2- Instituting a leak protection program.

3- Introducing measures to protect the finished waterproofing from physical damage.

4- Where the structure contains a slope, installation of slope stabilization measures.

5- Installation of a root-barrier layer.

6- Laying out key drainage and irrigation components including drain access chambers, and internal drainage conduit.

7- Installation of walk ways and path to make green roofs publically accessible.

8- Testing of irrigation systems, where the green roof is actually a roof garden.

9- Installation of the drainage layer.

10- Covering the drainage layer with the separation fabric.[53]

[52] This data is based on the market conditions as they existed in 2004. The present values may vary due to inflation.
[53] Pennsylvania Stormwater Best Management Practices Manual, December 30, 2006 at 132.

Third, decision makers need to address the issue of green roof maintenance. This concern further encompasses various minor concerns. For example, initially, during the plant establishment period, the roof may require periodic irrigation. Also, during the plant establishment period, a few visits to conduct basic weeding, and fertilization are required.[54]

Finally, decision makers must achieve integrated decision making which involves pro-active citizen participation. The decision makers need to accelerate the pace of change to cross traditional boundaries and envision a new relationship between the city or municipality, its government, the environment and citizens. This may be attained through one or more of the following efforts: (1) releasing city's installation plans so citizens may readily access anticipatory government planning, (2) releasing specific targets that decision makers seek to attain, and the temporal requirements for such targets, (3) releasing proposals for a new zoning code which will require green roofing on a certain square footage of property, (4) offering monetary or other appropriate incentives, and (5) making progress reports from time to time and publishing them to apprise people of the project's reality.[55]

Additionally, decision makers must consider effective implementation. Pragmatically, communities do not want to pay taxes for failing to undertake greening efforts. Thus, decision makers at both the local and state level have the responsibility to develop creative incentives that attain local participation. Offering a tax credit is one such incentive. Another alternative is a provision attaching a lien on subsequent commercial building owners – that is, not a lien on existing building owners, but on those property owners' buildings who purchase property after the effective date of the ordinance.

---

[54] Id. at 134.

[55] *See generally* Green City Clean Waters, The City of Philadelphia's Program for Combined Sewer Overflow Control Program, (June 1, 2011), http://www.phillywatersheds.org/doc/GCCW_AmendedJune2011_LOWRES-web.pdf.

VI. **Conclusion**:

In conclusion, green roofs are a multi-purpose sustainable method of tackling stormwater runoff problems. Additionally, they serve functions which include energy savings for structures where they are installed, enhanced scenic view of the structure, protection of biodiversity, especially the flora used in the installation of the green roof, and providing families with a recreational, yet sustainable area to carry out family oriented activities. The installation of green roofs in other jurisdictions indicates that it is an attainable target, and if the decision makers correctly invite public participation, green roofs may potentially become an integral part of residential and commercial structures. Furthermore, since greening efforts function better through effective participation of society at all levels, it is better to create incentives and invite such participation rather than imposing penalties for lack thereof.

ATTACHMENT

GREEN ROOF ORDINANCE

_____ MUNICIPALITY, _____ COUNTY
ORDINANCE NO. _____

AN ORDINANCE OF _____ MUNICIPALITY, _____ COUNTY, MANDATING INSTALLATION OF GREEN ROOFS FOR CERTAIN BUILDINGS; CREATING THE POSITION OF AN ENVIRONMENTAL ENGINEER[56]; ESTABLISHING PROCEDURES FOR THE INSTALLATION AND MAINTENANCE OF GREEN ROOFS IN _____ MUNICIPALITY; AND PRESCRIBING PENALTIES FOR NON-CONFORMANCE.

Whereas, inadequate maintenance of stormwater facilities contributes to erosion and sedimentation, overburdens the carrying capacity of streams and storm sewers, increases the cost of public facilities to carry and control stormwater, reduces groundwater recharge, threatens public health and safety, and increases pollution of water resources; and

Whereas, stormwater is an important water resource, which provides groundwater recharge for water supplies and base flow of streams, and also protects and maintains surface water quality; and

Whereas, the public, health, safety and general welfare, and the quality of the environment are jeopardized if stormwater runoff is not properly managed in an environmentally sound manner; and

Whereas, green roofs can help prevent stormwater runoff by capturing rainwater and returning it into atmosphere transpiration and evaporation.

AND NOW, THEREFORE, BE IT ENACTED AND ORDAINED by the Board of Supervisors of _____ Municipality, _____ County, Pennsylvania, AND IT IS HEREBY ENACTED AND ORDAINED by the authority of the same, as follows:

SECTION 1. Definitions: As used in this ordinance, the following terms shall have the indicated meaning, unless a different meaning clearly appears from the context:

[56] It is recommended that the "Environmental Engineer" be a person or entity with specialized knowledge in Best Management Practices. For the purposes of this ordinance, the "Environmental Engineer" shall seek to achieve the environmental goals of the Municipality using both substantive and procedural expertise for installation of green roofs.

"BUSINESS": Carrying on or exercising for gain or profit, any trade, business, profession, vocation, or commercial activity, or any rendering or professional services, except as an employee of another.[57]

"BUSINESS PRIVILEGE TAX[58]": A tax levied by the municipality on a business that is located in the municipality.

"ENVIRONMENTAL ENGINEER": A person with specialized knowledge of environmental law and possessing expertise in the process of installing green roofs.[59]

"GREEN PERMIT PROGRAM": A program that requires applicants to submit green roof permit application to the [here, the municipality should include the department that will grant permits to green roof applications for installing green roofs].

"GREEN ROOF": A roof that is either partially or completely covered in vegetation on top of the human-made roofing structure.[60]

"GROSS FLOOR AREA" The total enclosed floor area of all floors of a building, including mezzanines, measured from the exterior faces of exterior walls and from the center line of walls separating buildings, including basement, lobbies, common areas, elevator shafts, stairwells, mechanical or equipment rooms, common corridors, storage areas, enclosed garages, attics, and any other fully enclosed spaces of the building.[61]

"STORMWATER": Runoff from precipitation, snowmelt, surface runoff and drainage.[62]

"SUBSTANTIAL REHABILITATION": Required repairs, improvements that involve the replacement of two or more major components of a building, or the cost of which exceeds fifteen percent, exclusive of any soft costs, of the property's replacement cost (fair market value) after completion of all required repairs, replacements and improvements. A component is deemed major if it is significant to the building and is not merely minor or cosmetic.[63]

---

[57] Berkheimer Tax Administrator, Business Privilege Tax, (2015), http://www.hab-inc.com/taxpayer-resource-center/business-privilege-tax.

[58] For those municipalities that do not levy a business privilege tax, they may provide an equivalent tax credit on the gross income of the business.

[59] The Municipality, in its discretion, may define "specialized knowledge of environmental law" and may require the "Environment Engineer" to have installed a specific number of green roofs before appointing the person or entity to such position.

[60] The GRO Green Roof Code, Green Roof Code of Best Practice for the UK, (2011), http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=GRO_Green_Roof_Code.pdf; It is recommended that the Municipality adopting this ordinance define "partially covered area" by means of specific percentage tailored to the environmental goals of such Municipality.

[61] Mountain Brook PUD Application, Definitions, (2012), http://www.mtnbrook.org/Sites/Mountain_Brook/Documents/Main/revisions%20for%20PC%20meeting%20April%202.pdf.

[62] 25 Pa.Code § 102.

[63] United States Department of Housing and Urban Development, rehabilitation projects, (last visited November 8, 2015), http://portal.hud.gov/hudportal/documents/huddoc?id=44601c4HSGH.pdf; Examples of major components

SECTION 2. Environmental Engineer. (a) Appointment: An environment engineer shall be appointed by the board of supervisors or hired pursuant to a contract approved by the board of supervisors to serve at the pleasure of the board or for the term of the contract. (b) Jurisdiction: The environmental engineer shall serve a radius of [reasonable miles to be decided by the municipality in exercise of its discretion][64]. (c) Enforcement: The environmental engineer along with the _____ municipality solicitors shall have concurrent responsibility for the enforcement of this ordinance. The environmental engineer shall not have the authority to levy taxes or penalties under this ordinance of _____ Municipality.

SECTION 3. Green roof installation. Any new construction, or any substantial rehabilitation of an existing building, that totals 25,000 square feet or more of gross floor area[65] must, after obtaining a permit under section 4, install a green roof to tackle stormwater runoff,[66] or pay penalties under section 12.

SECTION 4: Green permit application[67]. An applicant must submit a green permit request to [here, the municipality should include the name of the department that it chose under the definition section]. The permit application must contain the following details:

(1) Structural calculations signed and sealed by an environmental engineer;

(2) A green roof plan which is signed by the environmental engineer;

(3) The project address;

(4) Building elevations including all necessary dimensions to determine the height of the building;

(5) An original embossed building survey conducted within the last 60 days of permit submittal; and

---

include but are not limited to roof structures, wall or floor structures, foundations, plumbing, central heating or electrical systems. Id.

[64] Under no circumstance is a Municipality permitted to appoint more than three Environmental Engineers for that Municipality.

[65] The Municipality adopting this ordinance may, in its discretion, modify the square footage required for installation of green roofs to effectuate its environmental goals. Furthermore, the language in this section is not intended to discourage building owners with less than 25,000 square footage to take initiatives to install green roofs.

[66] The City of Cambridge, Massachusetts, zoning ordinance, (2015), https://www.cambridgema.gov/~/media/Files/CDD/ZoningDevel/Ordinance/zo_article22_1363.ashx.

[67] This permit application is not limited to green roof applicants. If municipality deems fit, it may employ the same permit application system for all other green technologies like rainwater harvesting, solar panels, solar thermal panels, wind turbines and so on. *See generally* City of Chicago, Department of Buildings, Green Permit Program, Project Submittal Checklist, http://www.cityofchicago.org/content/dam/city/depts/bldgs/general/GreenPermit/Green_Roof_Checklistada.pdf

(6) Green roof details provided by the green roof manufacturer.[68]

SECTION 5: Permit fee. An applicant shall submit a [reasonable fee determined by the municipality] with the green permit application.

SECTION 6. Green roof fee credit. A green permit applicant under section 5, shall receive a credit of [reasonable amount set by the municipality] per square foot if the application pertains to green roof installation.[69]

SECTION 7: Approval of green permit application. A green permit application under section 5 shall be approved only if the following criteria are met:

(1) The department [designated by the municipality to accept green permit applications] deems that all requirements under section 5 have been satisfied;

(2) The department [designated by the municipality to accept green permit applications] conducts an independent inspection of the subject building and determines that a green roof shall be economically and environmentally viable[70]; and

(3) The department [designated by the municipality to accept green permit applications], receives a certification statement from the green roof manufacturer or its authorized agent stating "I hereby certify that the green roof plans for building [identify the building using parcel identification number or street address] were prepared by [name of the manufacturer] and to the best of my professional knowledge, they comply with the provisions of this ordinance."[71]

SECTION 8. The installation process. An environmental engineer shall, subject to individual requirements of each project and approval from the Department of Licenses and Inspections or another functionally equivalent department, employ all of the following steps to install green roofs over buildings that meet the requirements under section 3:

(1) Visual inspection of the completed waterproofing to identify any patent defects. The waterproofing must be tested for water tightness by the roofing applicator.

(2) Instituting a leak protection program.

---

[68] Id.
[69] Id.
[70] This provision is for the protection of the building owner. It seeks to prevent economic waste and unnecessary costs that the building owner might incur if green roof installation is not economically viable or would not serve its underlying environmental function. For the economic and environmental viability of green roof, such department may rely on the expertise of the environmental engineer.
[71] City of Chicago, Department of Buildings, Green Permit Program, Project Submittal Checklist, http://www.cityofchicago.org/content/dam/city/depts/bldgs/general/GreenPermit/Green_Roof_Checklistada.pdf

(3) Introducing measures to protect the finished waterproofing from physical damage.

(4) Where the structure contains a slope, installation of slope stabilization measures.

(5) Installation of a root barrier.

(6) Laying out key drainage and irrigation components including drain access chambers, and internal drainage conduit.

(7) Installation of walkways and path to make the green roof publically accessible.

(8) Testing the irrigation system.

(9) Installation of a drainage layer.

(10) Covering the drainage layer with a separation fabric.[72]

(11) Periodic testing of the amount of stormwater runoff reinstated into ground water.[73]

SECTION 9. Tax credits. A building owner[74] who successfully abides by the provisions of this ordinance shall, once the green roof has been installed, receive a tax credit as follows:

(1) A credit against the business privilege tax or its functional equivalent of twenty-five percent of all costs incurred to construct the green roof, provided that the total credit shall not exceed $100,000.[75]

(2) The tax credit shall be applied against the applicant's total business privilege tax liability for the tax year in which the applicant certifies the completion of the green roof.

---

[72] Pennsylvania Stormwater Best Management Practices Manual, December 30, 2006 at 132.

[73] Since water captured by green roof is returned into the atmosphere by evaporation and restoration as groundwater, the environmental engineer may install a gauge in the drainage layer to track the amount of water reinstated as groundwater. This gauge will only track water that flows back to groundwater since evaporated water will not be visible on the gauge.

[74] "Building owners" refers to owners of buildings whose specifications meet the criterial defined under section 3. However, subject to approval by the municipality, small business owners may undertake the green permit process mentioned herein and reap tax benefits after successful installation of a green roof.

[75] Green Roof Tax Credit, Philadelphia's Public-Private Economic Development Corporation, (last visited November 8, 2015), http://philadelphiaretail.com/pdf/GreenRoofTaxCredit.pdf; The Municipality, may use its sound discretion and change the tax credit threshold to another appropriate amount that it deems fit.

(3) The building owner receiving the tax credit may carry forward any unused tax credit until fully used.

(4) The tax credit shall be non-refundable and non-transferable to any other entity.[76]

SECTION 10. Contents of the tax credit application. A tax credit applicant must submit an application with the municipality setting forth all of the following:

(1) The plans for a green roof, which must provide for green roof coverage of at least [here, the Municipality may include the percentage it wants to be partially covered as green roof if the roof is not completely green.].

(2) The total cost of installing the green roof.

(3) The applicant's commitment to maintain the green roof for a period of five years[77] after the date of its completion and the applicant's acknowledgment that a failure to abide by provisions of the municipality shall be followed by repayment of corresponding tax credits.[78]

Section 11. Additional requirements. In addition to the requirements under section 11, an applicant must satisfy all of the following requirements to qualify for receiving tax credits:

(1) The building permit for green roof must be issued by the Department of Licenses and Inspections or another functionally equivalent department in the municipality.

(2) The application must be signed by the environmental engineer to attest the sustainability of the roof.

(3) An applicant must remain fully compliant with any other tax ordinances in force in the municipality.[79]

[76] The Municipality, in its sound discretion may permit such tax credits to be either refundable or transferrable or both.
[77] The Municipality may, in its sound discretion, increase or decrease this duration to tailor the life of green roofs to its environmental goals.
[78] Green Roof Tax Credit, Philadelphia's Public-Private Economic Development Corporation, (last visited November 8, 2015), http://philadelphiaretail.com/pdf/GreenRoofTaxCredit.pdf.
[79] Id.

SECTION 12. Penalties.[80] Penalties shall be administered as follows:

(a) A subsequent purchaser of an existing building, while not required to install a green roof, may receive a tax credit under section 9, upon successfully installing a functional green roof, subject to approval by the municipality.

(b) New building owners,[81] who fail to install functional green roofs after the effective date of this ordinance, shall be penalized as follows:

(1) A new owner of a building measuring 25,000 square feet or more but less than 50,000 square feet shall be required to pay an annual fine in the amount of [a reasonable fine to be determined by the municipality] to the municipality. The proceeds from the fines shall be used by the municipality to spread awareness about the advantages of green roofs and other best management practices for addressing stormwater runoff or other environmental hazards as the municipality deems fit.

(2) A new owner of a building measuring 50,000 square feet or more shall be required to pay an annual fine in the amount of [a reasonable fine to be determined by the municipality] to the municipality. The proceeds from the fines shall be used by the municipality to spread awareness about advantages of green roofs and other best management practices for addressing stormwater runoff or other environmental hazards as the municipality deems fit.

Section 13. Failure to pay penalties. A subsequent purchaser who fails to comply with provisions of this ordinance and fails to pay penalties under section 13, shall have a lien attached to its property in the amount of penalties due. For purposes of the lien, the Department of Revenue shall notify the municipality supervisors, who shall then instruct the environmental engineer to obtain a judgment lien against the defaulting property from a court of competent jurisdiction.[82]

SECTION 14. Repeals. All ordinances or parts of ordinances inconsistent with this Ordinance are hereby repealed insofar as they may be inconsistent herewith.

SECTION 15. Severability. The provision of this Ordinance are severable. If any sentence, clause, or section of this Ordinance is for any reason found to be unconstitutional, illegal, or invalid, such unconstitutionality, illegality, or invalidity shall not affect or impair any of the remaining provisions, sentences, clauses, or sections of

[80] Unlike other provisions of this ordinance, this section shall be applied retroactively. Furthermore, the Municipality, in its sound discretion, may postpone imposition of penalties to effectuate the underlying purpose of the ordinance—i.e., installation of green roofs to tackle stormwater runoff.

[81] "New building owners" refers to persons who construct newb buildings on empty lots after the effective date of the ordinance.

[82] A judgment lien attached pursuant to section 13 shall act as a judgment *in rem* and not a judgment *in personam* – that is, a failure to pay penalties shall only operate as a lien on the defaulter's property but shall not subject the defaulter to personal liability with respect to the outstanding amount.

this Ordinance. It is hereby declared to be the intent of the Board of Supervisors of _____ Municipality that this Ordinance would have been adopted had such unconstitutional, illegal, or invalid sentence, clause, or section not been included herein.

SECTION 16. Effective date. This ordinance shall become effective five (5) days after enactment.

ENACTED AND ORDAINED into law this _____ day of _____, 2_____.