GREEN INFRASTRUCTURE GUIDELINES FOR DEVENS PROJECTS

The redevelopment of the Devens Regional Enterprise Zone (Devens) is guided by the principles of sustainable development – recognizing the long-range consequences of current actions. This approach to redevelopment also recognizes the economic, social and environmental impacts of redevelopment and the interconnectedness of these triple-bottom line aspects of sustainable development. The Devens Enterprise Commission (DEC) Rules and Regulations governing the redevelopment of Devens contain a number of sustainable design standards that promote the conservation and integration of the natural environment with the built environment. In Devens, where and how you build is just as important as what you build. Connectivity of infrastructure services (roads, sewers, utilities, etc…) is important from a development perspective but so is connectivity of the natural environment to support biodiversity and help ensure preservation of important ecosystem services such as wildlife habitat, natural stormwater management and filtration, carbon capture and sequestration. Devens has been redeveloped with sufficient hard infrastructure to support the energy, water, sewer and transportation needs of the built environment, while also connecting to and preserving important components of the natural environment. This approach results in high quality, attractive and functional development patterns that have proven to be more cost effective than traditional development techniques – further enhancing the sustainable redevelopment goals of Devens. This document is intended to provide applicants with a better understanding of what Green Infrastructure is, the local incentives to promote Green Infrastructure, and guidance on how to strategically locate and incorporate Green Infrastructure into projects to meet multiple regulatory requirements within the DEC Rules and Regulations.

What is Green Infrastructure?

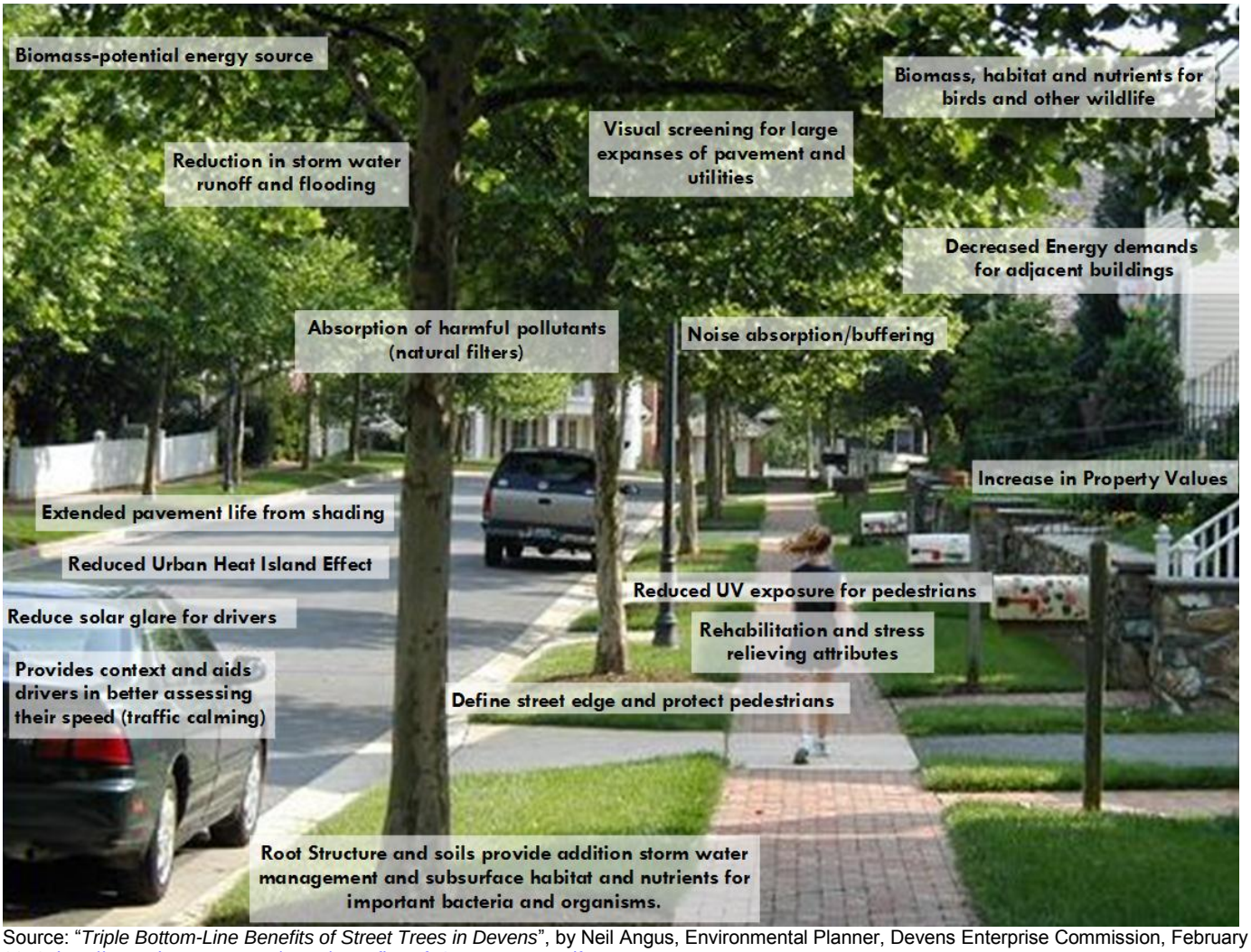
Green Infrastructure refers to natural, constructed, or restored landscape features that support fish, aquatic and terrestrial wildlife habitat and provide natural (and free!) ecosystem services such as water filtration and recharge; temperature moderation; erosion control; carbon capture and pollutant control; nutrient management, and food production. Green Infrastructure features may be natural such as forests, trail systems, floodplains, wetlands and buffer areas, or built/engineered features such as street trees, rain gardens, green roofs, bioretention areas and constructed wetlands (low-impact development or LID) that mimic or restore natural ecological processes. Green Infrastructure elements also help reduce wildlife habitat fragmentation and provide the ability for developments to better adapt to changing weather patterns through more direct and natural methods of stormwater management and infiltration which decrease flooding threats– resulting in less impacts from hazards (improved resiliency). Green Infrastructure in Devens also includes energy efficiency and renewable energy measures that help create a more sustainable network of built and natural systems. Incorporating Green Infrastructure elements into development projects can help meet your corporate sustainability objectives and the DEC regulations, all while saving money and enhancing the natural and built environment within Devens.

The Devens Open Space and Recreation Plan, Devens Main Post Trails Plan, Water Resources Protection Report and Stormwater Pollution Prevention Plan were all drafted as part of the planning and redevelopment for Devens. These plans and reports identify important natural areas and systems within Devens and the surrounding region and recommend certain levels of conservation and protection. Well planned developments can strategically identify these resource areas (i.e., wetlands, watercourses, steep slopes) and preserve and incorporate these elements and associated buffers as green infrastructure components and meet development screening, landscaping, water quality and viewshed protection requirements, while preserving the ecological structure and function of these natural areas at the same time.

Traditional parking lot design(curb, gutter and catch basin)

Low-Impact Development parking lot design (biofiltration)

Green Infrastructure elements are incorporated throughout the current DEC Rules and Regulations. A single Green Infrastructure element such as street trees or parking lot landscaping can be utilized to meet multiple regulatory requirements and sustainability objectives within the DEC Rules and Regulations:



Source: "*Triple Bottom-Line Benefits of Street Trees in Devens*", by Neil Angus, Environmental Planner, Devens Enterprise Commission, February 2012. http://www.devensec.com/news/Benefits_of_Street_Trees.pdf

As the above graphic shows, street tree plantings can replicate many natural ecosystem services and can act as corridors or connections to larger, unfragmented ecological habitats as well as provide many added benefits for people and properties nearby (triple-bottom line attributes of sustainable development). All of these benefits also apply to the vegetative screening that Devens requires for parking lots. A listing of Green Infrastructure elements and the corresponding DEC regulations that these elements address are listed in Appendix A. Graphic examples of commercial and residential Green Infrastructure applications can also be found in Appendix B.

Green Infrastructure Incentives in Devens:

The DEC offers a number of regulatory and financial incentives for projects that incorporate certain sustainable and green infrastructure elements:

Expedited Permitting: To Applicants, time is money. It is often said, the greenest of green buildings is often the adaptive reuse of existing buildings. The DEC recognizes these points and has committed to a maximum 21-day permitting timeframe for projects utilizing existing buildings (where no exterior site improvements are required). This helps reduce the environmental footprint of new development and expands on the DEC's already expedited Unified Permitting Process which commits to Level 2 Unified Permitting of projects within 75 days.

Stormwater Management Credit for Green Roofs: For projects that incorporate vegetated roofs, the area of roof covered by vegetation may be considered pervious and subtracted from the total proposed impervious area [974 CMR 4.08(5)]. This reduces the overall quantity of stormwater that is required to be managed on-site and can reduce the size of associated stormwater management systems, thereby saving land and money.

Relaxed Frontage Requirements for more Energy &Water Efficient Development: Applicants that agree to construct residential projects to a Home Energy Rating System (HERS) of 60 or less and incorporate EPA Water Sense labeled plumbing fixtures in all buildings are eligible for reduced lot frontage requirements. This allows for more

clustered approaches to development which reduces the development footprint and associated infrastructure costs [974 CMR 5.02(2)].

***Additional Street Types**:* The DEC recently revised its Regulations to include additional street types which allow for reduced pavement widths and /infrastructure costs (refer to 974 CMR 2.07).

Renewable Energy Building and Electrical Permit Fee Reductions: to incentivize the integration of Renewable Energy Facilities at Devens and further promote clean energy, greenhouse gas reduction and improved air quality; the DEC has adopted a reduced Unified, Building and Electrical Permit fee schedule for renewable energy installations for both ground-mounted and building mounted/integrated systems.

Financial incentives for LEED projects: The US Green Building Council's Leadership in Energy and Environmental Design (LEED) green building certification program requires a number of green infrastructure components be designed and constructed into a project that is pursuing certification (landscaping, energy efficiency, low-impact stormwater management, reduced development footprint management, etc…). As this program embodies the same sustainable development principles as Devens, completed projects that achieve LEED certification can be reimbursed up to 15% of their unified permit fee (maximum $10,000).

Green Infrastructure in Devens – Low-Impact Development/Bio-Filtration Landscape Island Case Study:
One Jackson Place (27 Jackson Road, Devens, MA)

Total Traditional Project Cost:	**$1,004,000**
LID Reduced site paving	-$32,000
LID Reduced curbing	-$50,000
LID Reduced stormwater piping	-$14,000
LID Reduced stormwater structures	-$68,000
LID Increased landscaping	+$12,000
LID Increased site preparation	+$10,000
LID Increased soil mix	+$18,000
Total Estimated LID Savings:	**-$124,000 (12%)**

Depressed landscape islands with specialized plantings and soil mix to naturally filter and infiltrate stormwater runoff while providing wildlife habitat connections through the site to adjacent larger forested areas.

For additional information or questions, please contact Devens Enterprise Commission staff
neilangus@devensec.com or 978.772.8831.

Resources:

1. UNH Stormwater Center: http://www.unh.edu/unhsc/– Case Studies on economics of LID techniques: http://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/docs/FTL_Resource%20Manual_LR.pdf
2. Devens LID Case Study: www.devensec.com/sustain.htm
3. MA Smart Growth/Smart Energy Toolkit: http://www.mass.gov/envir/smart_growth_toolkit/pages/mod-lid.html
4. MA DEP Stormwater Management Standards Structural Specifications for BMP's: http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/v2c2.pdf
5. BioMap 2: Conserving the Biodiversity of Massachusetts in a Changing World: http://maps.massgis.state.ma.us/dfg/biomap2.htm

Green Infrastructure Guidelines:

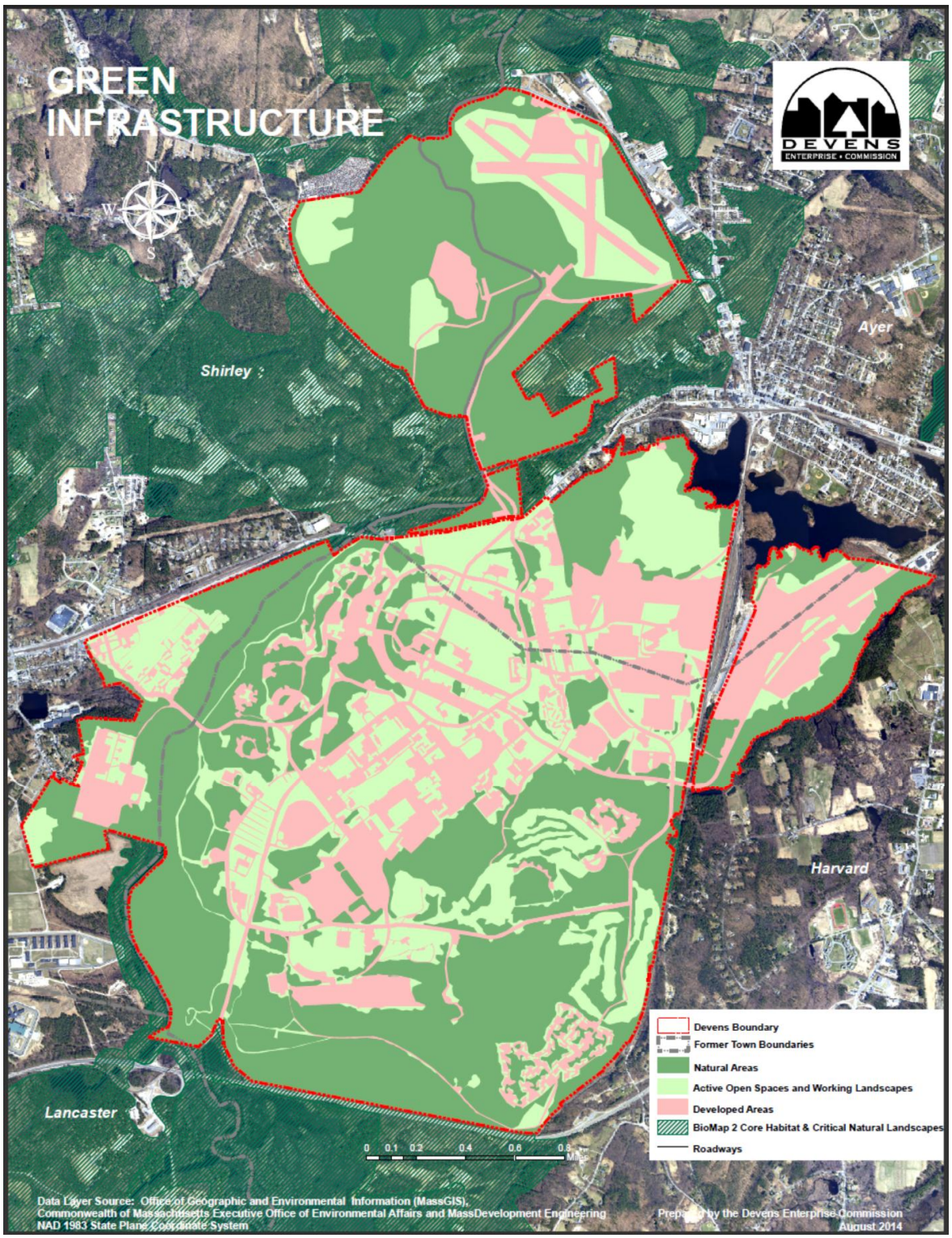
1. **Green Infrastructure Objectives.** All development projects within Devens should be designed to incorporate Green Infrastructure elements that meet one or more of the following objectives:
    a. **Protect and use existing vegetation.** Minimize disruption to existing habitats by incorporating site design that protects existing healthy and native vegetation and minimizes the development footprint (tight construction disturbance zone limits).
    b. **Facilitate connections.** Incorporate landscape design elements into all proposed projects to facilitate green infrastructure connections/linkages to surrounding natural landscapes to the maximum extent feasible. 974 CMR 3.04(8)(d)5. requires areas of previously cleared woodlands that are not utilized on project sites to be re-planted with native woodland species. Edges of previously cleared woodlands on-site are also required to be planted with mix of vegetation types.
    c. **Vegetation types**. Support biodiversity, reduced pesticide use, and water conservation by using native plants species that have adapted to site conditions and local climate zones (see 974 CMR 3.06 Appendix A for a list of native plants). Also prohibit planting of invasive species (a full and updated list is available from the Invasive Plant Atlas of New England – IPANE).
    d. **Energy/Micro-climate.** Reduce building energy consumption by maximizing solar orientation of buildings and incorporating passive energy design features to maximize energy efficiency to the maximum extent practicable. Projects are encouraged to consider the placement of appropriate vegetation or vegetated structures in strategic locations adjacent to buildings. Projects may also be designed to offset additional building energy demands to the maximum extent practicable through added efficiencies such as district energy systems and/or renewable energy systems. Where feasible, projects may also incorporate urban heat island reduction elements such as shade trees, green roofs, or vegetated structures to cover non-vegetated surfaces such as walls, walkways and parking lots.
    e. **LID/Stormwater Management.** Use low-impact development stormwater management techniques to facilitate green infrastructure connections throughout proposed developments.
    f. **Landscape Management.** Develop long-term invasive species monitoring, control and removal program as part of the Long Term Operations and Maintenance Plan for the site. Refer to Appendix B for examples of Commercial/Industrial and Residential Applications.
2. **The Devens Green Infrastructure and Landscape Matrix Map** divide Devens into three (3) landscape areas/classifications. Projects located within one or more of these areas are encouraged to incorporate green infrastructure components that are functional and facilitate connections to or enhance larger contiguous landscape patches. See ***Appendix A*** for a list of Green Infrastructure technologies and ***Appendix B*** for graphic examples of Commercial/Industrial and Residential Applications.

DEVENS GREEN INFRASTRUTURE AND LANDSCAPE MATRIX

Dark Green: **Natural Lands.** All proposed projects within these areas may preserve and incorporate green infrastructure linkages and connections within these areas in accordance with DEC Landscaping requirements 974 CMR 3.04(8).

Light Green: **Active Open Spaces, Working Landscapes and Existing LID**. All proposed projects within these areas may incorporate landscape designs that connect to/expand existing Natural lands within the immediate vicinity in accordance with 974 CMR 3.04(8)(d)5. and 974 CMR 3.04(8) in general.

Red: **Developed Areas.** All proposed projects within these areas may incorporate landscape designs in accordance with 974 CMR 3.04(8) that, where feasible, facilitate connections to surrounding Natural Lands, Active Open Spaces, Working Landscapes and Existing LID as per 974 CMR 3.04(8)(d)5.



**Core Habitat and Critical Natural Landscapes from the BioMap 2 are shown in green hash marks outside of Devens boundaries. These areas are generally contiguous with "Natural Lands" within Devens, further emphasizing the importance of maintaining and facilitating green infrastructure connections to and from these areas.*

APPENDIX A – Devens Green Infrastructure Elements:

Below is a list of green infrastructure elements and technologies that should be considered by all Applicants, along with links to the applicable DEC regulations that such components can satisfy. As this table demonstrates, many individual green infrastructure components can satisfy multiple regulatory requirements. Please note, the DEC supports innovation and recognizes this is not a complete list of Green Infrastructure elements and technologies. New or alternative Green Infrastructure elements and technologies not listed below may be acceptable, provided the Applicant demonstrates to the DEC the appropriateness of such measures in meeting the applicable provisions of the DEC Rules and Regulations.

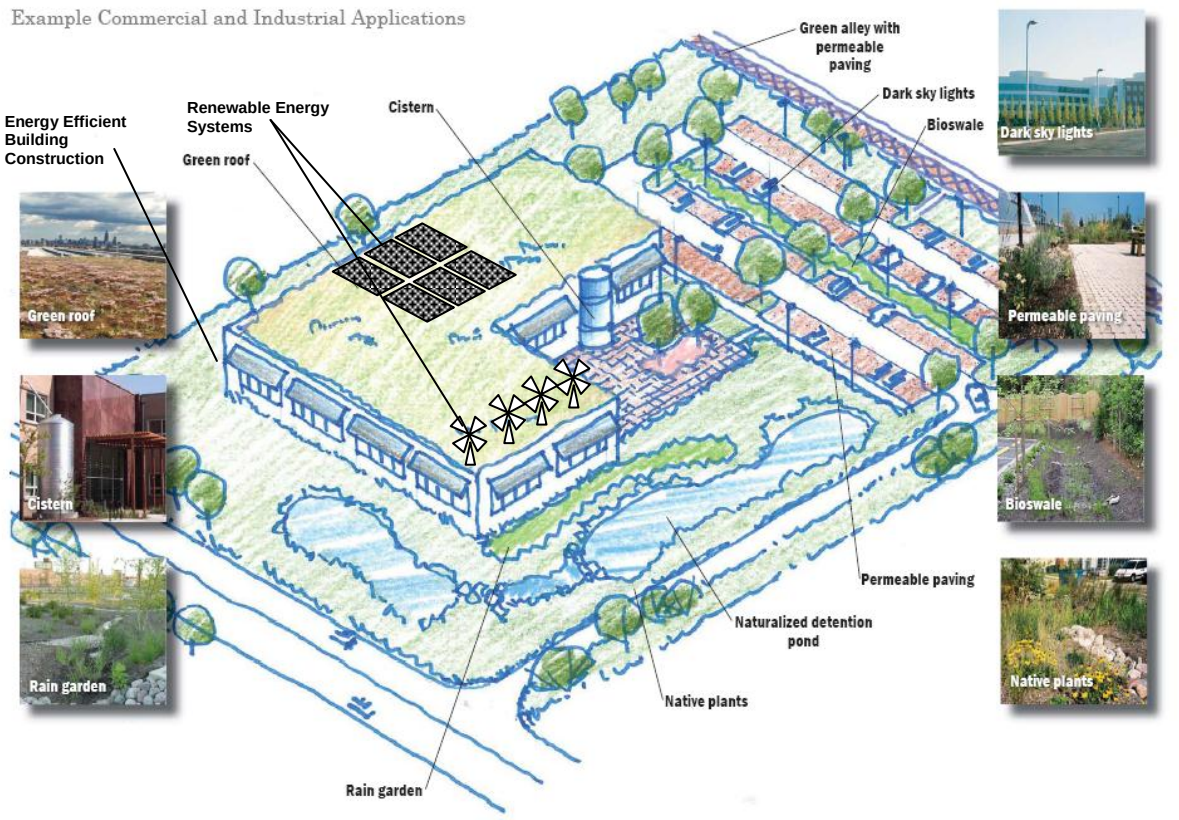
GREEN INFRASTRUCTURE ELEMENTS	EXAMPLES OF DEC REGULATIONS ADDRESSED
General Landscape Design Elements:	
Preservation of tracts/corridors of existing native vegetation, topography and native wildlife habitat.	Stormwater Management - 974 CMR 3.04(4) Topographic Alterations – 974 CMR 3.04(5) Site Improvements - sidewalks/trails 974 CMR 3.04(6)(d) Preservation of existing vegetation - 974 CMR 3.04(8)(d) Restoration of vegetation - 974 CMR 3.04(8)(d)5. Use of native plants - 974 CMR 3.04(8)(c) Minimize lawn areas 974 CMR 3.04(8)(f) Viewshed Overlay Districts - 974 CMR 3.04(8)(i) Steep Slope Protection – 974 CMR 3.06 Industrial performance standards for light and noise - 974 CMR 4.04 &5 Wetland Protection 974 CMR 4.06 Water Resource Protection – 974 CMR 4.09 Greenhouse Gas Mitigation – 974 CMR 4.11 Innovative Residential Development – 974 CMR 5.02(1)(k)
Restoration of habitat	Preservation of existing vegetation - 974 CMR 3.04(8)(d) Topographic Alterations – 974 CMR 3.04(5) Screening - 974 CMR 3.04(8)(g) Wetland Protection 974 CMR 4.06 Water Resource Protection – 974 CMR 4.09 Greenhouse Gas Mitigation – 974 CMR 4.11
Trails and greenway connections	Site Improvements - sidewalks/trails 974 CMR 3.04(6)(d) Stormwater Management - 974 CMR 3.04(4) Greenhouse Gas Mitigation – 974 CMR 4.11 Innovative Residential Development – 974 CMR 5.02(1) and (2)
Landscaping Plantings	Use of native plants - 974 CMR 3.04(8)(c) Screening - 974 CMR 3.04(8)(g) Minimize lawn areas 974 CMR 3.04(8)(f) Parking Landscaping requirements - 974 CMR 3.04(8)(h) Industrial performance standards for light and noise - 974 CMR 4.04 &5 Greenhouse Gas Mitigation – 974 CMR 4.11
Control and management of invasive species	Use of native plants - 974 CMR 3.04(8)(c) Maintenance requirements:- 974 CMR 3.04(8)(n) Wetland Protection 974 CMR 4.06
Impervious surface reductions (urban heat island)	Parking Landscaping requirements - 974 CMR 3.04(8)(h) Industrial performance standards for light and noise - 974 CMR 4.04 &5 Parking maximums - Devens Bylaws Article C Stormwater Management - 974 CMR 3.04(4) Innovative Residential Development – 974 CMR 5.02(1) and (2) Vegetated roofs and walls - 974 CMR 3.04(8)(g)(i)(5)
Reduce/eliminate potable water use for irrigation	Xeriscaping and greywater reuse 974 CMR 3.04(8)(c) Use of native plants - 974 CMR 3.04(8)(c) Minimize lawn areas - 974 CMR 3.04(8)(f) Maintenance requirements - 974 CMR 3.04(8)(n) Stormwater Management - 974 CMR 3.04(4) Water Resource Protection – 974 CMR 4.09 Controls on in-ground irrigation systems - 974 CMR 8.09(11)
Created Wetlands	Screening - 974 CMR 3.04(8)(g) Use of native plants - 974 CMR 3.04(8)(c) Stormwater Management - 974 CMR 3.04(4) Stormwater Management Design Standards – 974 CMR 4.08 Water Resource Protection – 974 CMR 4.09
Preservation of Steep Slopes	Screening - 974 CMR 3.04(8)(g) Slope Resource Areas - 974 CMR 3.06 Innovative Residential Development – 974 CMR 5.02(1) and (2)
Vegetative screening	Screening - 974 CMR 3.04(8)(g) Use of native plants - 974 CMR 3.04(8)(c) Building façade screening requirements:- 974 CMR 3.04(8)(l) Industrial performance standards for light and noise - 974 CMR 4.04 &5 Parking Landscaping requirements - 974 CMR 3.04(8)(h) Viewshed Overlay Districts - 974 CMR 3.04(8)(i) Greenhouse Gas Mitigation – 974 CMR 4.11

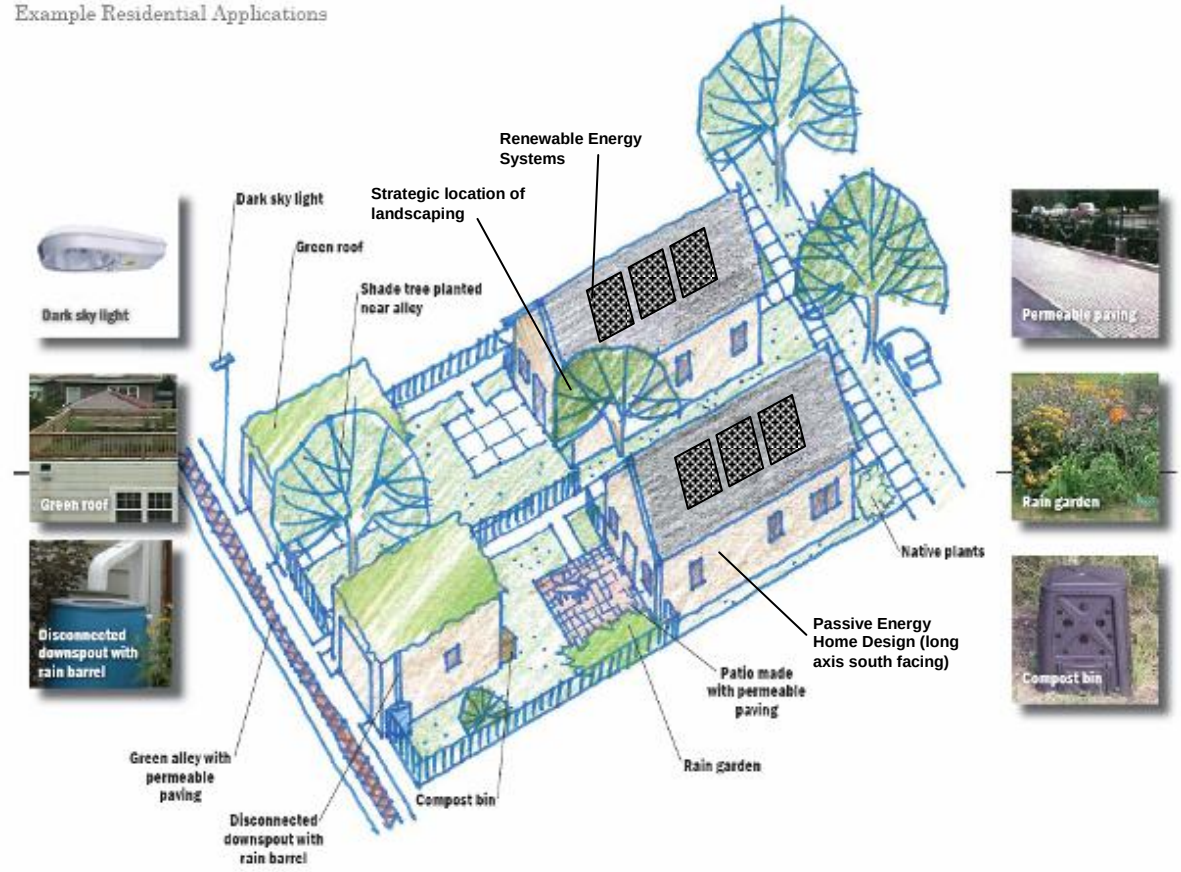
GREEN INFRASTRUCTURE ELEMENTS	EXAMPLES OF DEC REGULATIONS ADDRESSED
General Landscape Design Elements cont…	
Edible landscapes	Plants lists – 974 CMR 3.07(5) Innovative Residential Development – 974 CMR 5.02(1) and (2) Vegetated roofs and walls - 974 CMR 3.04(8)(g)(i)(5)
Building and Site Design Elements:	
Low-Impact Development Stormwater Mgm't - on-site stormwater management requirements	Stormwater Management - 974 CMR 3.04(4) Stormwater Management Design Standards – 974 CMR 4.08 Parking Landscaping requirements - 974 CMR 3.04(8)(h) Water Resource Protection – 974 CMR 4.09 Innovative Residential Development – 974 CMR 5.02(1) and (2) Vegetated roofs and walls - 974 CMR 3.04(8)(g)(i)(5)
Minimizing building heating and cooling requirements with landscaping	Screening - 974 CMR 3.04(8)(g) Building façade screening requirements:- 974 CMR 3.04(8)(l) Vegetated roofs and walls - 974 CMR 3.04(8)(g)(i)(5) Industrial performance standards for light and noise - 974 CMR 4.04 &5 Greenhouse Gas Mitigation – 974 CMR 4.11
Manage, improve, recharge and reuse stormwater on-site to the maximum extent feasible	Screening - 974 CMR 3.04(8)(g) Stormwater Management - 974 CMR 3.04(4) Vegetated roofs and walls - 974 CMR 3.04(8)(g)(i)(5) Stormwater Management Design Standards – 974 CMR 4.08 Water Resource Protection – 974 CMR 4.09 Controls on in-ground irrigation systems - 974 CMR 8.09(11)
Rain gardens	Use of native plants - 974 CMR 3.04(8)(c) Stormwater Management - 974 CMR 3.04(4)\ Stormwater Management Design Standards – 974 CMR 4.08 Water Resource Protection – 974 CMR 4.09
Decentralized infiltration systems	Use of native plants - 974 CMR 3.04(8)(c) Stormwater Management - 974 CMR 3.04(4) Vegetated roofs and walls - 974 CMR 3.04(8)(g)(i)(5) Stormwater Management Design Standards – 974 CMR 4.08 Water Resource Protection – 974 CMR 4.09
Rain barrels/cisterns	Stormwater Management - 974 CMR 3.04(4)\ Maintenance requirements:- 974 CMR 3.04(8)(n) Water Resource Protection – 974 CMR 4.09 Controls on in-ground irrigation systems - 974 CMR 8.09(11)
Green roofs/green walls (refer to DEC Vegetated Roof Policy)	Screening - 974 CMR 3.04(8)(g) Vegetated roofs and walls - 974 CMR 3.04(8)(g)(i)(5) Water Resource Protection – 974 CMR 4.09 Use of native plants - 974 CMR 3.04(8)(c) Building façade screening requirements:- 974 CMR 3.04(8)(l) Stormwater Management - 974 CMR 3.04(4) Stormwater Management Design Standards – 974 CMR 4.08 Greenhouse Gas Mitigation – 974 CMR 4.11
Minimizing cut and fill and development footprint	Topographic Alterations – 974 CMR 3.04(5) Preservation of existing vegetation - 974 CMR 3.04(8)(d) Minimize lawn areas 974 CMR 3.04(8)(f) Industrial performance standards for light and noise - 974 CMR 4.04 &5 Water Resource Protection – 974 CMR 4.09 Innovative Residential Development – 974 CMR 5.02(1) and (2) Greenhouse Gas Mitigation – 974 CMR 4.11
Naturalized Erosion and Sediment Controls	Plan requirements - 974 CMR 3.02(3)(e) Stormwater Management - 974 CMR 3.04(4) Stormwater Management Design Standards – 974 CMR 4.08 Water Resource Protection – 974 CMR 4.09
Infrastructure Elements*:	
Street types/widths, stormwater mgm't and landscape treatments within Road Rights-Of-Ways (ROW)	Landscaping Requirements within ROW - 974 CMR 2.07(2) and (7) Use of native plants - 974 CMR 3.04(8)(c) Industrial performance standards for light and noise - 974 CMR 4.04 &5 Stormwater Management for Streets – 974 CMR 2.07(6) Greenhouse Gas Mitigation – 974 CMR 4.11 Innovative Residential Development – 974 CMR 5.02(1)(e)
Traffic calming measures incorporating landscaping/biofiltration	Traffic calming - 974 CMR 2.07(3) Stormwater Management for Streets – 974 CMR 2.07(6) Use of native plants - 974 CMR 3.04(8)(c) Street tree requirements - 974 CMR 3.04(8)(k) Industrial performance standards for light and noise - 974 CMR 4.04 &5 Greenhouse Gas Mitigation – 974 CMR 4.11 Innovative Residential Development – 974 CMR 5.02(1) and (2)
Permeable and pervious paving systems	Stormwater Management - 974 CMR 3.04(4) Stormwater Management Design Standards – 974 CMR 4.08

GREEN INFRASTRUCTURE ELEMENTS	EXAMPLES OF DEC REGULATIONS ADDRESSED
Infrastructure Elements*cont…:	
Street trees with tighter spacing (30-40' vs. traditional 50')	Street tree requirements - 974 CMR 3.04(8)(k) Industrial performance standards for light and noise - 974 CMR 4.04 &5 Screening - 974 CMR 3.04(8)(g) Use of native plants - 974 CMR 3.04(8)(c) Greenhouse Gas Mitigation – 974 CMR 4.11 Innovative Residential Development – 974 CMR 5.02(1) and (2)
Biofiltration swales	Use of native plants - 974 CMR 3.04(8)(c) Stormwater Management - 974 CMR 3.04(4) Stormwater Management Design Standards – 974 CMR 4.08
Floodplain, stream, wetland, riparian buffer protection and/or restoration	Wetland Protection 974 CMR 4.06 Stormwater Management - 974 CMR 3.04(4) Stormwater Management Design Standards – 974 CMR 4.08 Greenhouse Gas Mitigation – 974 CMR 4.11
Community parks/permanently protected open space	Greenhouse Gas Mitigation – 974 CMR 4.11 Use of native plants - 974 CMR 3.04(8)(c) Stormwater Management - 974 CMR 3.04(4) Preservation of existing vegetation - 974 CMR 3.04(8)(d) Site Improvements - sidewalks/trails 974 CMR 3.04(6)(d) Restoration of vegetation - 974 CMR 3.04(8)(d)5. Innovative Residential Development – 974 CMR 5.02(1)(k)
Community gardens	Innovative Residential Development – 974 CMR 5.02(1) and (2)
Integrated waste management systems	Greenhouse Gas Mitigation – 974 CMR 4.11
Water Conservation and Efficiency	Use of native plants - 974 CMR 3.04(8)(c) Stormwater Management - 974 CMR 3.04(4) Maintenance requirements:- 974 CMR 3.04(8)(n) Greywater reuse - MA DEP regulatory provisions for greywater systems Innovative Residential Development – 974 CMR 5.02(1) and (2) Controls on in-ground irrigation systems - 974 CMR 8.09(11)
Ground source heat pumps, cogeneration and other energy efficiency infrastructure	Greenhouse Gas Mitigation – 974 CMR 4.11 Innovative Residential Development – 974 CMR 5.02(1) and (2)
District energy systems	Innovative Residential Development – 974 CMR 5.02(1) and (2) Greenhouse Gas Mitigation – 974 CMR 4.11
Renewable energy systems (including solar canopies for renewable energy generation and heat-island reduction)	Renewable Energy Facility Requirements – 974 CMR 4.10 Greenhouse Gas Mitigation – 974 CMR 4.11

*Transportation demand management programs that reduce single occupancy vehicle trips and promote alternative modes of transportation also contribute to reduced greenhouse gas emissions and improved public health and therefore qualify as green infrastructure components. For details on TDM in Devens, go to: http://www.devensec.com/development/TMI_Overview.pdf

APPENDIX B - Example Commercial, Industrial and Residential Applications:





Base drawings from the Chicago Green Alley Handbook. This information is being provided for informational purposes to assist applicants as part of the Devens Enterprise Commission expedited Unified Permitting process.