



Green Roofs for Existing School Buildings

This handout was adapted from the New York City School Construction Authority manual on green roofs.



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This paper is intended to provide some general guidance to school groups who are considering pursuing a green roof installation project. It will point out issues and associated requirements for installation and use of Green Roofs, and will answer some commonly asked questions.

We'll start with the difficult, but real demands of a Green Roof project.

Requirements for Funding and Construction:

Before proceeding with any design work, an estimate of the total project cost must be prepared and submitted for review. In addition, funding for the work must be secured before any construction can begin. Any Capital project must be bid out in accordance with SCA's public procurement rules and procedures.

In considering a Green Roof installation, what are the issues that need to be addressed as far as the physical building?

- **Existing Roof condition:**

The existing roof will need to be in good condition, or will need to be replaced, before the project begins. Logically, once the Green Roof assembly is in place, making repairs to a failing roof below is difficult and disruptive. An evaluation of the existing roof must be made by a qualified tradesperson or professional, and it will need to be reviewed for approval by DOE and SCA. The evaluation must include an assessment of the condition of the roof membrane, flashing, masonry and roof penetrations, and the existing roof drains and drainage system. If the existing roof requires replacement, the cost can range from \$25 to \$50 per square foot, depending on the roofing system and whether or not asbestos abatement will be required. If the roof replacement involves work on the masonry parapet or the drainage system, the cost will increase further. It is therefore important to have a cost estimate developed along with the existing roof evaluation.

- **Structural Loading:**

Because the Green Roof will add weight to be carried by the roof structure, a Structural Engineer should establish the existing structural capacity, and determine whether or not adding the weight of the Green Roof components, and potentially a group of people, is allowable. There are many roofs where a quick determination can be made that the existing building as designed is not suitable for a Green Roof. The proposing entity must be able to fund the investigation of the suitability for those roofs where a decision is less clear cut. DOE and SCA can often provide plans for the roof, and, in some cases, other related information.

- **Equipment Maintenance Access Paths**

A sustainable Green Roof must include pavers and walkways for access to existing roof top equipment. When laying out the vegetation plan, your designer will need to consider how the roof is used by the maintenance staff. The paver path must be configured to permit access to all of the equipment, and must be wide enough to allow for the use of service equipment such as ladders. The plan will be reviewed for these access issues.

- **Egress from the Green Roof;**

Proper code-mandated egress – typically 2 stairs that open onto the Green Roof area - would need to be provided if the project anticipates visitors to the roof. Note that the number of visitors at any one time would need to be held to fewer than 75 so as not to invoke Public Assembly requirements. (This number may decrease to 50 when the new NYC Building Code takes effect.) An Architect or Engineer should review the existing conditions to make sure that this life safety aspect is in compliance with the Building Code.

- **Accessibility required for the Green Roof:**

If the school envisions the Green Roof as a classroom, to be programmed regularly as other classrooms are, then it will be considered a "new use", and handicapped accessibility (Local Law 58 compliance) would need to be provided as well as other safety features that the Building Code requires for an "occupied classroom". In this case, an Architect should be engaged to define the scope of work necessary to provide an accessible route that would allow a non-ambulatory person to travel from the sidewalk outside the school up to the roof.

If the intention for the Green Roof project is not to provide a classroom, but rather a working example of a sustainable, vegetative roof, where a teacher might bring students to the roof for the purpose of experiencing first-hand the roofs environmental benefits, as ancillary to instruction, no additional accessibility enhancement is required. In this case, where the roof is not "accessible", the school should also supply a small scale version of the Green environment in a classroom or outside at grade, to ensure the same ancillary educational opportunity for all students.

- **Student Safety on the Green Roof:**

If students and staff are anticipated to come to the roof for observation, measurement and recording activities, a tall, fence-type protective barrier will need to be provided at the perimeter of the roof area as a safety measure. This installation will need to be planned by the Architect or Engineer to ensure that it doesn't negatively impact the waterproof envelope of the building.

Also a clear path for circulation must be provided for visitors to the roof so that the Green Roof system can be maintained to its full, productive benefit.

Advice on considering a Green Roof project for a school building:

Depending on how ambitious your plans are, and on the conditions of the existing school building, the project may be quite expensive, or even cost-prohibitive. Work with an Architect or Engineer up front on planning in order to identify the requirements and an estimate of cost for the potential project.

The additional maintenance and operational cost for Green Roofs used for "ancillary" teaching is expected to be \$1,000/10,000SF of roof. Where the roof is used for full teaching, the cost of maintaining the equipment needed to access the roof, and regular cleaning of the space used for teaching will add to the cost above. It is anticipated that the annualized cost will be \$2,500/1000 SF of teaching space, plus \$1,500 annually for the equipment needed for accessibility. These

costs need to be addressed and included in any request for a Green Roof. If the cost is too great consider planning a green space at the yard level of your school building.

Any planting proposed for the Green Roof must be approved by DOE/SCA. This is required regardless of whether the space is intended for use as a classroom with special plantings or as a sustainable, vegetative roof. In general, only sedum or other hardy low maintenance ground cover, will be allowed. The preferable installation method is using modular polypropylene planting trays of a size capable of being relocated by a maximum of two persons using manual equipment.

No plantings can be fully self sustainable. All Green Roof systems recognize the need for providing fertilizer or admixture. It is critical that the fertilizers or plant additives be compatible with the roofing system as well as the plants. The Green Roof Proposal must include a maintenance plan that includes proposed use of fertilizers (type, amount and frequency), weeding (responsible person and frequency) and replacement plan when some of the plantings die off.

Where the Green Roof is to be installed over an existing roof, consideration should be given to having direct feeds to the roof drains from the planting or otherwise isolating the roof membrane from any chemical run-off from the planting.

Your Division of School Facilities managers should be involved up front as well – you will need their support for the project from the beginning to end. For costly projects involving capital construction work (roof replacement, and other major work in the building), the School Construction Authority should be involved for at Design Review at a minimum.

Now, if you're still interested in pursuing a Green Roof project, these are some potential benefits.

What is a “Green Roof”?

The primary function of the Green Roof is the same as any other roof – it keeps water from entering the school building. The Green Roof, like any other roof, includes a roofing membrane that separates the potentially wet outside from the dry inside. However, the Green Roof , providing a planted roof environment of sedum or other hardy, low-growing ground cover that will not require irrigation, has other environmental benefits which include:

- **Storm Water (Rain Water) Management**

The rain water that is absorbed and held by the planting substrate of the Green Roof will never enter the city's sewer system, but rather will irrigate the plants, and evaporate into the atmosphere providing a cooling effect. An added benefit is that the quality of rain water that does drain through the Green Roof into the sewer system is greatly enhanced due to the filtering effect of the planting substrate.

- **Roof Life Extension**

Roofing material exposed to the heat and ultra-violet rays of the sun is under constant thermal stress, and will, over time, deteriorate, crack and leak. A Green Roof provides a layer of soil which protects the roofing membrane from the direct effects of the sun, and lessens the temperature fluctuations between day and night. The Green Roof system therefore tends to increase the useful life expectancy of the roofing membrane.

- **Reduction of the “Heat Island Effect”**

The vegetative roof minimizes the heat-trapping ability that is the hallmark of dark-colored impervious roofing material. This reduction of the “heat island effect” is supported by the evaporative cooling effect of the system. In this way the Green Roof reduces the summer cooling load for the building, and as a result the size of HVAC equipment can be decreased and the energy cost for operating the equipment is lessened.

Air quality is affected by heat waves, and as the temperature rises, ozone depletion increases. A Green Roof, due to its natural cooling effect, reduces warming trends. The net result is improved air quality and better quality of life for all, in particular people suffering with pulmonary diseases.

Can the Green Roof offer a learning opportunity?

A secondary benefit of a Green Roof for the school community will be offering this roof as a working example of a sustainable, vegetative roof with environmental benefits. The Green Roof might be ancillary to the school science (or perhaps other) curriculum, where a teacher might bring students to the roof for the purpose of experiencing first-hand the environmental benefits noted above. The data collection and recording about these aspects of the Green Roof might include: temperature differences on the green roof as opposed to the asphalt play yard below; amount of rain fall as opposed to amount of water actually being drained off the roof; protective effect of the green roofing system on the roofing membrane; the rates of plant growth in response to temperature and water, air quality at the Green Roof as opposed to on the sidewalk outside, etc. The Green Roof then becomes one more part of the students' experience of the varied urban ecosystem.



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