



## Watch Factory - Waltham, MA Methodology for Landscape Performance Benefits

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### Environmental

**Reduces the rate of peak runoff discharge to the Charles River by 8.4 cfs or 9% for the 25 year, 24 hour storm event. The Charles River is a diverse ecosystem, home to 28 known fish species.**

Watershed Modeling was performed using Hydro CAD. This is based largely on the hydrology techniques developed by the Soil Conservation Service (SCS/NRCS). From there, a comprehensive model was developed for both pre-development and post-development conditions to assess the effects of the proposed development for both the site and surrounding areas. The current stormwater management system has been designed to reduce the post-development storm water runoff rates for the 2, 10, 25 and 100 year rainfall events (see below). Duration is one-half hour of rainfall.

Storm Frequency	Pre-Development Peak Runoff Flows (cfs)	Post Development Runoff Flows (cfs)	Reduction in Peak Runoff Flows (cfs)
2-Year	63.28	58.49	4.79
10-Year	108.38	101.45	6.93
25-Year	135.47	127.07	8.4
100-Year	172.38	164.42	7.96

**Table 1.** Peak Runoff flows across site. *Courtesy: BSC Group – Civil Engineers*

127.07/135.47 = 9 % reduction for the 25 year, 24 hour storm event.

**Improves the quality of runoff discharged into the Charles River by decreasing nitrate loading by 30-50%, phosphate loading by 30-40%, and increasing dissolved oxygen by 60%, according to water quality sampling data.**

A key component to the Watch Factory design is the performative engineering of the water management system; from roof downspout to river. This system aims to enhance water quality parameters while providing aesthetic beauty and integral value to the courtyard spaces. Within its larger context, the landscape responsibly contributes to the Charles River, a regional body which stretches approximately 80 miles across eastern Massachusetts. Some of the most crucial metrics to the ecological health of this system include dissolved oxygen and phosphate, which provide quality habitat for the existence of most aquatic species. Another major aspect is the reduction of nitrate, which leads to eutrophication and drastic temperature increase in river systems. These factors were quantified in an effort to analyze performance of the conveyance systems at play, which directly impact the larger watershed.



**Figure 1.** Gathering water samples from manholes.

Two points of testing (per courtyard):

Source point (either roof gutter or very top of rain garden). Untreated storm water.

Manhole (invert) (samples taken from within pipe). Treated water from rain gardens.

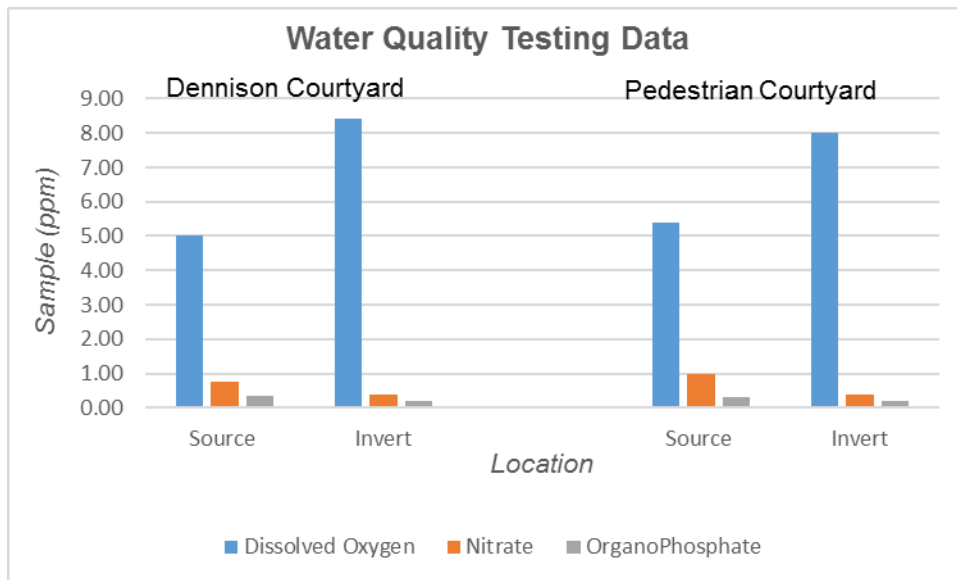
Two samples from each test point were gathered for accuracy. Each bottle was labeled and sealed. All titrations in testing based on a scale of 10 ppm/per sample testing.

Dissolved oxygen (D.O) test conducted immediately using the azide-modified Winkler titration method, results recorded.

Phosphate and nitrate test conducted using a colorimetric testing method. Results recorded.

Source point sample average – Invert sample average = water quality difference as %.

Testing conducted during rain event in the month of June, 2013. The team concluded that a more frequent sampling during multiple events would have been beneficial for a more comprehensive and comparative analysis.



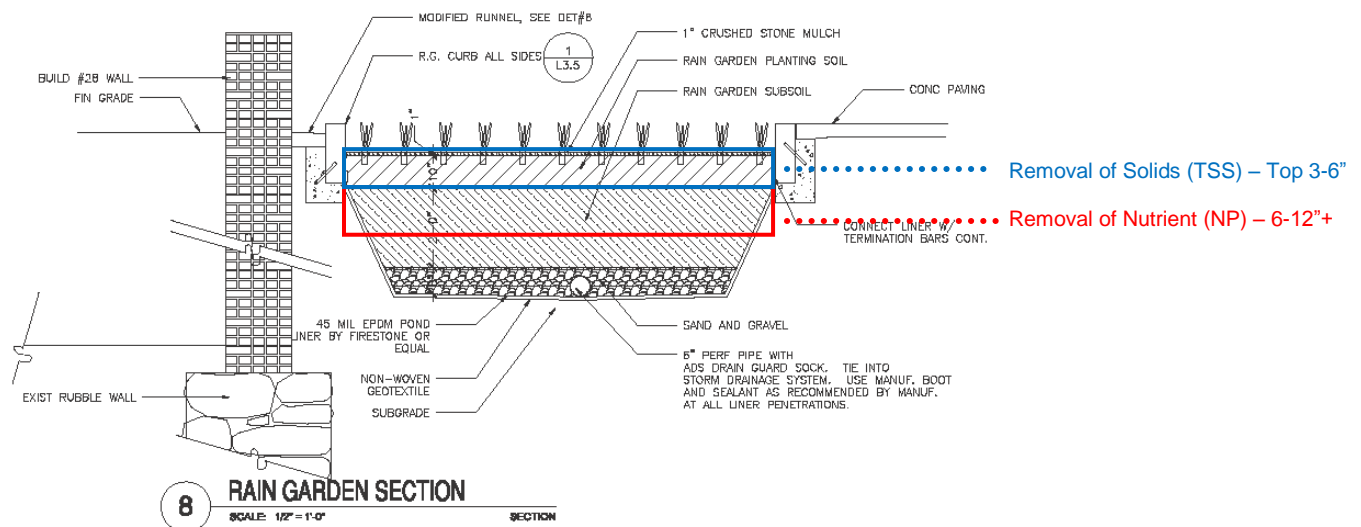
**Table 2.** Field results of water quality sampling, comparing the two courtyards.

*Limitations:*

- 1.) Study does not reflect the overall water quality improvement, but rather focused on the improvement within the Pedestrian and Dennison courtyards.
- 2.) Since only a single testing event occurred, the results do not reflect trends in water quality improvement over a duration of monthly or yearly rainfall events.

**Reduces total suspended solids and metals by 90% and non-point contributors such as oils and grease by 67% by using vegetated rain gardens to manage roof and sheet flow runoff.**

The Watch Factory landscape utilizes specific LID practices to assure optimal management of stormwater, including rain gardens which act as bio retention areas. According to similar field testing performed by Alan P. Davis et al of the Maryland Water Resources center, slowed velocity of water during retention allows for sedimentation, removing 90% of total suspended metals and solids per sample. Tests were conducted by Professor Davis and his team.



**Figure 2.** Detail of Rain Garden showing depths of growing mediums in relationship to their function at the Watch Factory.

An experiment was completed in June 1999 in Largo, Maryland. This system, which was installed approximately 1 year earlier, was retrofitted into an existing curbside inlet at a parking island. The media consisted of 50% construction sand, 20-30% leaf mulch, and 20 to 30% topsoil, similar to the soil profiles used in the Watch Factory rain gardens. A T-shaped underdrain runs the span of the entire system, branching to the inlet at a depth of 128 cm. Mulch made up most of the surface, with some grasses, bushes, and small trees. An area that encompassed approximately 2.4 m was tested (area = approximately 8 ft).

*Limitations:*

- 3.) Comparison made based on size and similar attributes. Results are secondary and applied to the scale of a typical bioremediation area present in the Watch Factory.

According to field studies conducted at the University of Virginia, similar BMP practice focused on “space limited” BMP’s within a local high school landscape. Test areas consisted of a similar sized retention area to that in the Watch Factory courtyards, planted with grasses and perennials, tested during 22 different storm events. Overall, this BMP practice removed up to 67% of oil and grease present. Natural microbial process initiates the uptake of pollutants through the root mass of the rain garden plantings. Specific environmental conditions can also encourage volatilization, in which pollutant traces are evaporated through plant tissue into the atmosphere

**Decreases summertime ambient air temperature in the Prospect Parking area by 13°F through the preservation of established shade trees.**

With the assistance of a certified Arborist, the project team gave priority to preserve the mature tree species on the northwestern side of the buildings, which include one large sugar maple and a mature oak. Among other benefits, the preservation of mature shade trees enhances storm water infiltration, increases property values, and provides cooling cost reduction for nearby buildings. All ambient temperatures on the site were determined by the research team using a manufacturer heat sensor gun during a late afternoon visit in July.

As measured in Robbins Courtyard: 83 degrees F  
As measured at Prospect St lot courtyard: 70 degrees F

**Social**

**Provides adequate opportunities for recreation and exercise along the waterfront for 78% of tenants surveyed.**

The research team submitted a survey monkey questionnaire to four businesses in the Watch Factory, and received responses from 30 individuals. The questionnaire included five questions, each of which was carefully determined by the research team. The most significant findings were highlighted by the research team as social benefits.

*Question #1: Do you feel the Watch Factory’s location provides adequate opportunity for recreation and exercise along the waterfront?*

78% yes  
22% no

*Question #2: Do you feel the courtyards provide a sense of relaxation and peace?*

66% yes  
34% no

*Question #3: How often do you visit the courtyards?*

12% more than 1x per week  
27% once every 2 weeks  
30% at least once a month  
31% I have never visited

*Question #4: Do you comprehend the stormwater management system as a unique benefit?*

69% yes  
31% no

*Question #5: Would you be willing to learn more about the stormwater management system?*

93% yes  
7% no

**Demonstrated storm water management as a unique benefit for 69% of tenants surveyed and piqued the interest of 93%, who indicated that they would be willing to learn more about the storm water management system.**

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