Planning and Technical Support for Incorporating Green Infrastructure in Long Term Control Plans

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Prepared for:

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In partnership with the

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Executive Summary

In 2013, the New Jersey Department of Environmental Protection started the process of requiring that municipalities and utilities address their combined sewer overflows (CSOs), which are the discharge of untreated sewage from a city's combined sewer system into an adjacent water body, largely as a result of rain or other precipitation. This is to be accomplished through the development of Long Term Control Plans (LTCP) for stormwater management. Conventional stormwater infrastructure can be costly and difficult to plan, design, and construct given regulatory, environmental, economic, and real estate restrictions of many urban environments. Green Infrastructure (GI) is a largely decentralized and potentially lower-cost alternative stormwater management strategy that can reduce the volume of runoff at its source, while simultaneously providing communities with a number of other valuable co-benefits. New Jersey DEP, like the federal Environmental Protection Agency, has recognized green infrastructure as an important part of an integrated solution to water management.

With two representative study areas within the City of Perth Amboy as a subject, this study demonstrates the potential effectiveness that GI can have in reducing the amount of stormwater entering the combined sewer system. Overall, it is anticipated that through the interventions described in this report a 25%-30% reduction in wet weather flow can be accomplished through the utilization of green infrastructure, with a 20% average reduction in peak flow rates. This can be accomplished with a capital investment of $2 million to $3 million for sewersheds of 40 to 50 acres in size, translating to an estimated investment of $40,000 to $75,000 per acre.

The study areas were selected based on typical land use typographies found within Perth Amboy and other combined sewer municipalities in New Jersey: one largely urban, medium to high density sewershed and one suburban, medium density sewershed. Though the focus in this report is on these two sewersheds in Perth Amboy, the framework is designed to be portable and replicable for use in other communities with similar challenges and similar results in the reduction of overall and peak flow rates would be anticipated.

The results presented in this report represent an iterative process in which community stakeholders were consistently engaged for input on all elements – from the study area selection down to the particular GI technologies and their locations prescribed. In particular the authors which to acknowledge the participation and input of the community, civic, and utility stakeholders represented on the Perth Amoby's SWIM committee.

An initial meeting was held with stakeholders to understand particular issues related to stormwater management within the communities of the City. Background information was then collected on Perth Amboy's sewer system, land cover, topography, and the presence of known contaminated sites, which was then used in conjunction with the information collected in the stakeholder meeting to identify four potential areas of study: two of higher density commercial/residential development and two of medium density residential development. These four alternatives were then taken back to the project stakeholders for review, discussion, modification, and selection of the final two areas for study. A "toolbox" of GI technologies was also presented to understand which interventions were more attractive for implementation. With the study areas then selected, site walkthroughs and data collection were then performed with a focus on supplementing and filling in the gaps of the collected background information. Soil samples were collected and cursory infiltration testing was performed. From this information a number of GI interventions were identified and discussed with project stakeholders. Using all of this information, baseline and 'greened' SWMM models were developed to compare the total reduction in runoff entering the combined sewer.

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Introduction and Summary of Findings

This report details the planning and technical aspects for incorporating green infrastructure (GI) in Long Term Control Plans for combined sewer overflow (CSO) mitigation using Perth Amboy, New Jersey as a model. The work was supported by resources provided by the NY-NJ Harbor & Estuary Program (HEP). With the Hudson-Raritan Estuary being one of the Nation's 28 Estuaries of National Significance, HEP was created by the U.S. Environmental Protection Agency (EPA) at the request of the governors of New York and New Jersey in 1988 as an ongoing effort to develop and implement a consensus driven plan to protect, conserve and restore the estuary.

In July 2015, the New Jersey Department of Environmental Protection issued new permits to the operators of combined sewer systems, requiring that they develop, adopt and implement Long Term Control Plans (LTCP) to control the discharges of raw sewage that result from CSOs. HEP has identified supporting implementation of green infrastructure opportunities in CSO communities as a key priority in its 2017-2022 Action Agenda. This project sought to identify, model, and investigate the feasibility of green infrastructure implementation in the City of Perth Amboy in a manner that helped inform other CSO municipalities and utilities seeking to address green infrastructure requirements of the CSO permit and LTCP.

The stakeholders engaged over the course of this project included representatives from the City of Perth Amboy Office of Economic and Community Development, the Middlesex County Office of Planning, the Middlesex County Utilities Authority, New Jersey Department of Environmental Protection (NJDEP), EPA, the Jersey Water Works collaborative, the New Jersey Harbor Dischargers Group, and the members of Perth Amboy SWIM (Stormwater Infrastructure Management). Perth Amboy SWIM is a collaboration of the City of Perth Amboy, Rutgers Cooperative Extension Water Resources Program (Rutgers University), NY/NJ Baykeeper, Raritan Riverkeeper, and representatives from the local community; SWIM seeks to assist the City in incorporating green infrastructure in CSO permit compliance and its LTCP through the implementation of green infrastructure projects, outreach efforts, and education programming.

To assist SWIM's efforts in Perth Amboy, and create a model for other CSO communities in the Estuary, HEP launched the project and eDesign Dynamics was selected through a public RFP process held by HEP in 2016. While an independent exercise, this effort was undertaken so that it could become a component of Perth Amboy and the Middlesex County Utility Authority's (the Utility) development of a LTCP in compliance with the Utility's New Jersey Pollutant Discharge Elimination System (NJPDES) permit.

An iterative process of project development followed where meetings were held with SWIM and other stakeholders every one to three months to present the particular findings from that period, to receive feedback on the green infrastructure options investigated, and to discuss additional alternatives for further investigation. Feedback was used to modify and refine modeling efforts, with new community and stakeholder goals being identified as new information became available, both from the model results and external sources.

Beginning with a kick-off meeting in May 2016, the project had three primary components: Data collection and stakeholder engagement, stormwater modeling, and reporting. Background data collected included historic maps of the area, sewer information, zoning information, parcel ownership information, soil information available from the Natural Resource Conservation Service, geologic and topographic information from the United States Geologic Survey, orthophotography, and previously prepared green infrastructure feasibility reports published by Rutgers University and NJDEP titled *Green Infrastructure Feasibility Perth Amboy* and *Evaluating Green Infrastructure: A Combined Sewer Overflow Control Alternative For Long Term Control Plans,* respectively. Field data was also collected after the approval of a Quality Assurance Project Plan (QAPP) by EPA, which included site photographs, locations of existing stormwater inlets, notes on local topographic variations (e.g. relative high and low points), soil boring logs, soil samples for mechanical analysis, and infiltration testing. This information was used, along with stakeholder requests for particular GI technologies and reported areas prone to flooding, to identify four potential study areas. With additional feedback from stakeholders, two areas were selected for study, one largely residential and one largely commercial. Based on desktop analysis findings, the two areas were deemed representative of land use in Perth Amboy and other New Jersey CSO communities, as indicated in the information provided in Table 1 (Initial background research), allowing these findings to be replicable and extrapolated for significantly larger areas than were studied.

While this report was being written, NJDEP released *Evaluating Green Infrastructure: A Combined Sewer Overflow Control Alternative for Long Term Control Plans* as a guideline document for assessing and implementing GI in New Jersey CSO communities (NJDEP, 2018). Although the guidance document was not available during the development of this project, the process followed contains many similarities to that outlined in NJDEP's document, particularly with respect to: locating and assessing GI feasibility; developing performance criteria; evaluating GI impacts on baseline conditions; addressing maintenance considerations; and developing cost estimates. In some instances, the order of the steps in the NJDEP guidance document is different from the order presented in this report. It is worth noting that Rutgers University *Green Infrastructure Feasibility Perth Amboy* also provides examples of tasks referenced in NJDEP's guidance document, particularly with respect to: compiling a geographic information system (GIS) database (i.e., topography, impervious coverage, parcel data, etc.), identification of GI feasible sites, field reconnaissance to verify desktop analysis, engage community or municipal input, and calculations of proposed GI practices effects.

A set of stormwater models were developed using EPA's Stormwater Management Model (SWMM) to assess the potential impacts of green infrastructure[1]. Overall, with full

[1] Please see the Methodology section for a discussion of the SWMM parameters used.

implementation of the GI opportunities identified, it is anticipated that a 25%-30% reduction in wet weather flow can be accomplished, with a 20% average reduction in peak flow rates and total reduction in sewer flow by as much as 8%. This can be accomplished with a capital investment of $2 million to $3 million, for sewersheds of 40 to 50 acres in size, translating to an estimated investment of $40,000 to $75,000 per acre. Given the geology of Perth Amboy, having soils with low infiltration rates due to a relatively high composition of silt and clay, it was also identified that GI with lower hydraulic loading ratios would infiltrate a greater percentage of runoff. Underdrain connections to the existing sewer system are also recommended for this condition, effectively reducing peak flow rates and wet weather flow, and allowing for the storage volume of GI to become available for subsequent storms.

The implementation section of this report discusses each of the GI technologies identified in this study in further detail. Cursory cost estimates and dollar-per-gallon of stormwater managed figures are provided for comparison and prioritization purposes. In general, right-of-way bioswales, when implemented to the widest degree possible, were found to be the most effective in reducing the total volume of wet weather flow and average peak flow rate compared to other GI examined. Bioswales were not, however, the most effective in reducing the total volume of sewer flow because the technology partially relies on detention and slow release to the sewer system to account for low infiltration rates. GI with a lower hydraulic loading ratio such as permeable pavement parking lot retrofits or Washington Park sub-surface storage basketball court retrofit, discussed in further detail, below, are more effective at reducing total discharge to the sewer. In general, it is advisable to maximize the footprint of the GI infiltration area where possible, given Perth Amboy's low infiltration rate soil conditions.

The distributed approach to implementing right-of-way bioswales upstream of existing stormwater inlets is a simple way to manage a large portion of the impervious surfaces composing an urban landscape – roadways and their adjacent sidewalks. Soil testing should be performed as a part of any GI feasibility investigation, but it should be noted that high silt and clay content or a history of filling activity resulting in highly variable soil conditions (urban fill), do not preclude effective GI implementation.

While the focus in this report is on two sewersheds in Perth Amboy, the framework is designed to be portable and replicable for use in other communities with similar challenges. CSS communities in northern New Jersey which may have similar clayey soils can utilize the results of this study more directly, while communities with sandier, more permeable soil can use that opportunity to achieve higher stormwater management volumes through greater infiltration and eliminating GI connections to the existing sewer altogether.

Methodology

Utilizing two representative study areas in the City of Perth Amboy, one residential and one commercial, the study identified and developed a set of GI opportunities to be modeled and compared against a baseline model to demonstrate the CSO mitigation potential from GI. A set of recommendations for GI was developed based on the cost of implementation, stormwater management potential, and the associated co-benefits for each GI practice. The process by which the study areas and GI opportunities were identified consisted of the collection and review of spatial information, interviews and meetings with City representatives and stakeholders, and the collection of field data pertaining to soil profiles, infiltration rates, and groundwater depths.

Overall, the methodology presented here is nearly identical to the one in the NJDEP's guidance document, the main difference being that a site scoring system was not developed to rank potential GI practices. However, a number of factors listed in the guidance document were addressed for different GI practices. These factors include cost and performance efficiency, maintenance considerations, community programming concerns, and a large suite of co-benefits associated with each GI practice to better assist stakeholders in selecting the most appropriate intervention. In addition, throughout the duration of the project a stronger emphasis was placed on community meetings and field reconnaissance to better identify sites meeting GI practice criteria.

INITIAL BACKGROUND RESEARCH

eDesign Dynamics (EDD) began its investigation with a kickoff meeting with HEP and project stakeholders held May 6, 2016, which included representatives from the City of Perth Amboy, the Middlesex County Office of Planning, the Middlesex County Utility Authority, NJDEP, EPA, Jersey Water Works, Rutgers, and NY/NJ Baykeeper. At this meeting the overall project goals were discussed and initial information was gathered pertaining to specific areas of interest to the stakeholders, along with direction to EDD as to where geographic and technical information could be found related to the city and its existing plans for GI development.

After the kickoff meeting, background information began to be collected on the city, which included the following:

- GIS data related to:
    - Land parcels and property ownership
    - Existing topography
    - Existing land cover
    - Existing water bodies
    - Known sites of soil contamination
    - Orthophotography
- Zoning information

- Historic USGS topographic maps showing historic water bodies
- Sewer characterization map in development for the City's LTCP
- Existing soil maps provided by the USDA National Resource Conservation Service
- Previously conducted green infrastructure study performed by Rutgers University

With this information and the input collected during the kickoff meeting, EDD identified four, 40 to 55-acre sewersheds for potential study areas. The four sewersheds were identified based on the following criteria:

- Two sewersheds with a typical high-density/commercial land use typology for the City of Perth Amboy;
- Two sewersheds with a typical low-to-medium density residential typology for the City of Perth Amboy; and
- Presence of little to no known areas of soil or groundwater contamination.

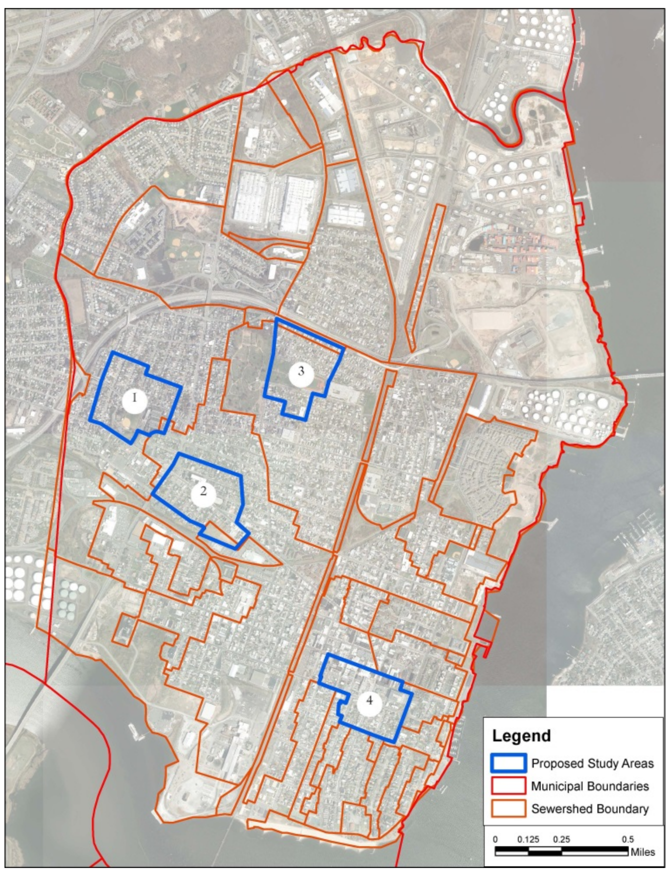


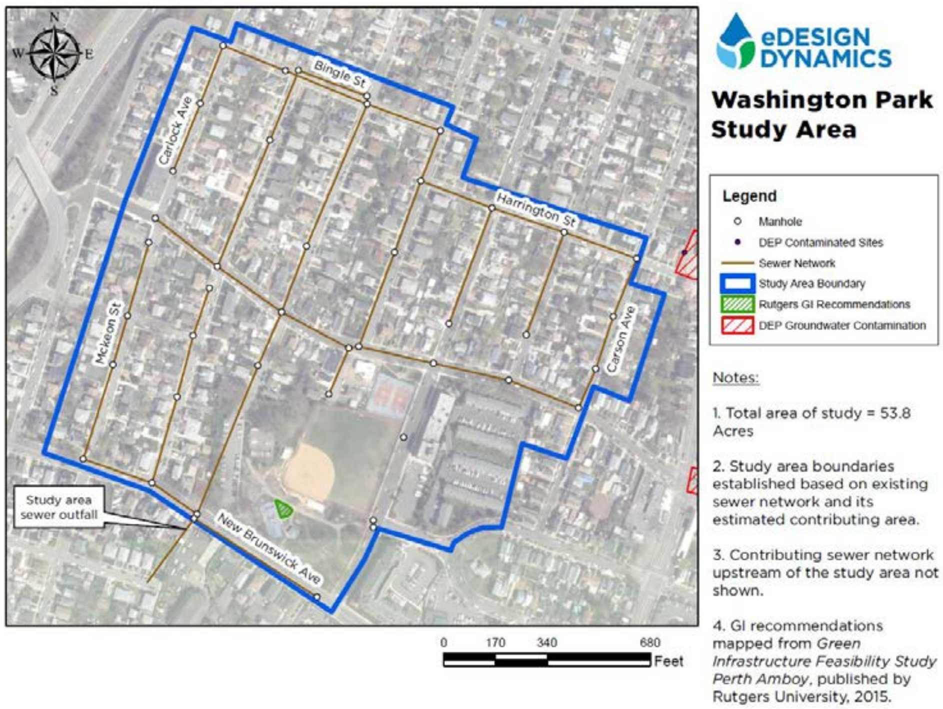
Figure 1 - Candidate Sewersheds

Candidate sewersheds were then presented to the stakeholders to discuss the potential benefits to be learned from focusing on each option, and to obtain feedback for any modifications to the candidate study areas. Key considerations included the current understanding of the relative potential benefits of GI for control of specific CSO outfalls as well as incorporating previously identified opportunities for GI. At the conclusion of this meeting, the proposed Washington Park low-to-medium density residential study area was selected by the stakeholders along with the downtown commercial district with the qualification that it be shifted further to the southeast to incorporate locations where SWIM and the City had previously identified opportunities for GI construction. These two selected sewersheds provide excellent examples of the types of land use/land cover found in urban communities where CSO's are used to manage stormwater. Comparison figures for the CSS communities in the State of New Jersey are provided in Table 1 below.

Table 1 - New Jersey CSS Municipalities impervious cover.

Municipality	County	% Impervious
Bayonne	Hudson	91.1
Camden	Camden	85.6
East Newark	Hudson	99.6
Elizabeth	Union	89.9
Fort Lee	Bergen	91.8
Gloucester City	Camden	77.6
Guttenberg	Hudson	99.1
Hackensack	Bergen	93.0
Harrison	Hudson	97.4
Hoboken	Hudson	99.1
Jersey City	Hudson	85.1
Kearny	Hudson	64.4
Newark	Essex	92.4
North Bergen	Hudson	79.0
Paterson	Passaic	93.2
Perth Amboy	Middlesex	90.6
Ridgefield Park	Bergen	79.2
Trenton	Mercer	90.4
Union City	Hudson	99.7
Weehawken	Hudson	96.9
West New York	Hudson	99.6
CSS MUNICIPALITY-WIDE		**87.7**
STATEWIDE		**31.5**

Sources:
Impervious Surface (2012), NJDEP Bureau of GIS
Municipal Boundaries, NJDEP Bureau of GIS



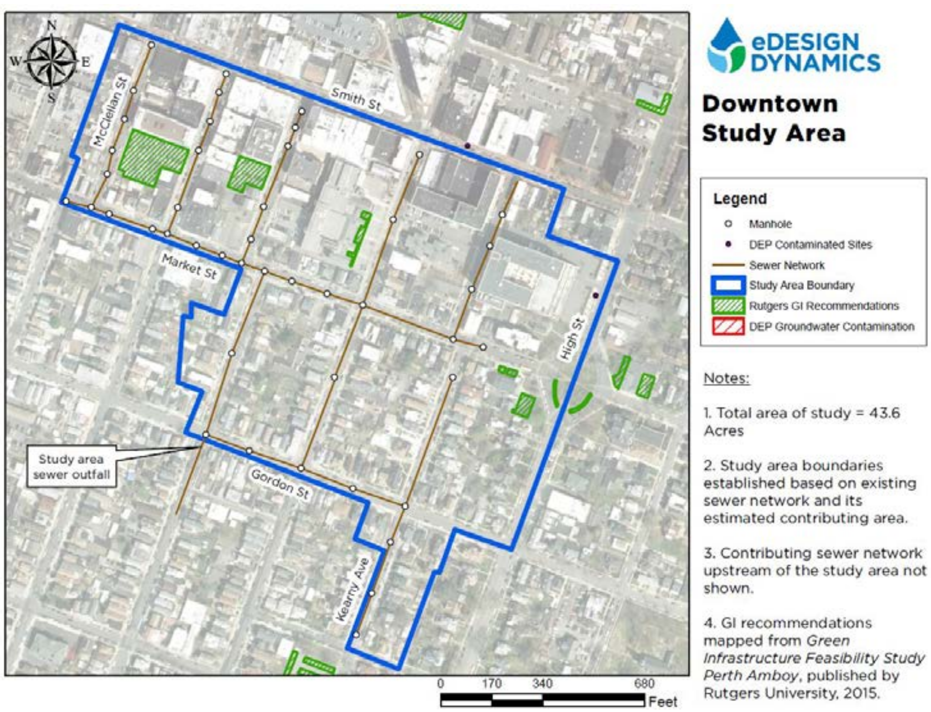


Figure 2 – Final Selected Sewersheds

Green Infrastructure Technology Selection

During the study area selection process, a "toolbox" of GI practices were presented to the project stakeholders for discussion and feedback. Once the study areas were finalized, the technologies from the toolbox were modified based on site conditions and the feedback received from stakeholders. In addition, a number of opportunities were also incorporated as a result of the work Rutgers University conducted in their GI feasibility study.

Once a set of practices were identified for focus and prioritization, site walkthroughs were conducted with a focus toward identifying ideal GI locations within the landscape based on observed topography, existing utilities, and known historic and current drainage pathways found in the collected site information and from stakeholder testimony. An initial GI plan was then developed for further input and discussion by stakeholders, which was then modified and incorporated into the SWMM model discussed below. As modeling proceeded, additional meetings were held with stakeholders to report on progress and obtain additional feedback on the GI plan for each area. The model was updated based on stakeholder feedback related to property ownership and political feasibility.

ADDITIONAL DATA COLLECTION

Site Investigation

With the two study areas identified, EDD developed site maps using the previously collected GIS data for recording notes during a series of site visits. The primary goal of the site visits was to identify the location of existing inlets, verify and correct any broad discrepancies between the collected topographic data and conditions in the field, and to identify opportunities for green infrastructure development. Each block within the study areas was walked and photographed. Larger contiguous sites within each study area were also entered and photographed, such as parks, playgrounds, and parking lots. Large plots of private property were photographed from their apparent boundaries (e.g. fence lines, walls, hedges, etc.).

Soil Sampling and Infiltration Testing

An additional two days were spent in the field taking soil samples for laboratory analysis. Prior to this work, a soil sampling plan was developed as a part of the Quality Assurance Project Plan (QAPP) which was submitted to and approved by the EPA. In this plan, two transects were drawn along each study area perpendicular to the general slope of the site. One transect was drawn approximately one third of the way downhill from the general high point of the study area, and a second was drawn approximately two thirds of the way downhill from the same point. Along each of these transects three soil sampling locations were identified, spaced equidistant from one another roughly one quarter, one half, and three quarters from the left to right of each transect. Thus, six locations were identified for each study area, twelve in total.

The final soil sampling locations were determined in the field based on the sampling plan, ensuring that samples were taken within the public right-of-way or in a public space such as a park or municipal parking lot. Using a 4-inch diameter, 6-inch long hand auger, a boring was performed at each location down to a depth of five feet below grade or until refusal. Due to the prevalence of large cobbles encountered in the soils, refusal was occasionally met at a depth shallower than 2.5 feet below grade. In these instances, a second attempt was made two feet from the original boring location. If a second attempt could not penetrate below 2.5 feet below grade, the boring was terminated. Soil boring logs were maintained for each location noting the color, texture, level of compaction (e.g. loose, moderately compact, dense), relative moisture content (e.g. dry, moist, saturated, etc.), and field identified USCS soil classification for each one-foot interval.

Approximately 16 ounce composite soil samples were collected for each location from the final one foot of each boring, held in gallon-sized zip-lock bags, labeled, and temporarily stored in a cooler until delivery to the laboratory. The remainder of the soil was used to backfill each boring prior to moving on to the next site. After two consecutive days of soil investigation, the samples were delivered to the Rutgers University New Jersey Agricultural Experiment Station Soil Testing Laboratory (Soil Lab) for soil mechanical analysis. Results for each sample were reported in percent sand, silt, and clay (see Appendix A).

Results from the mechanical analysis and field investigation were then compared to identify the most common soil types encountered, and four of the boring locations previously investigated were selected for permeability testing – two within the Washington Park study area and two within the Downtown study area.

Geotechnical investigations are typically required prior to siting and designing green infrastructure practices in order to determine soil characteristics and permeability rates. EDD performed a falling head permeability test by using a modified ASTM D6391 (Standard Test Method for Field Measurement of Hydraulic Conductivity Using Borehole Infiltration) method.

Using a 4-inch diameter soil auger, a hole was bored to a depth of five feet at each permeability testing location. A 4-inch diameter 6-foot PVC casing was then placed inside the borehole. The casing was centered within the borehole and pushed approximately one inch into the soil at the base of the hole. The PVC casing was filled with water, allowing the soil below the test location to saturate. The casing was intermittently topped-off, allowing the casing to remain full over a 30-minute period. Shortly before beginning the falling head test measurements, the temperature of the water in the casing was measured using a laser thermometer.

After the 30-minute saturation period, the casing was topped-off a final time and the water level in the casing was allowed to drop. The falling water level was then recorded at 1, 2, 3, 4, 5, 10 and 15 minute intervals, or until the water level reached the bottom of the casing. After the first test was completed, water was again filled to the top of the casing, keeping it full for a total of five minutes. A second test was performed by recording falling water levels at the same time intervals as the first test. A permeability rate was calculated (per ASTM D6391) from each test and the average of the two tests was reported as the final permeability rate for that location.

BASELINE SWMM MODELING

With the topographic data, orthophoto imagery, sewer system information, site walkthrough notes and photographs collected, a baseline stormwater model was developed using EPA SWMM 5.1. The orthophoto imagery was analyzed in GIS to identify roof cover and pervious cover polygons within each study area. The total area of roof and pervious cover was then subtracted from the study area to derive the amount of impervious cover at street level. Pervious cover and roof areas were selected for identification in the orthophoto imagery due to their ease of visual differentiation against adjacent surfaces and their relative lack of geometric complexity compared to common impervious surfaces such as sidewalks and roadways.

The sewer system was modeled using the information provided by the Middlesex County Utilities Authority's engineering consultant responsible for developing the sewer characterization map for Perth Amboy's LTCP. This included the existing pipe network connections, flow directions, and a partial identification of pipe diameters. Nodes were created for each manhole noted on the map, with pipes connecting to each node according to the existing pipe network configuration shown. At the most downstream end of the study area, a modeled outfall was created with free discharge. Since invert and slope information was not available, 6-inch invert differences between the lowest inflow pipe and outflow pipe, along with a minimum 1% slope for all pipes were assumed. Where pipe diameter information was not available, the diameter was assumed to equal the largest known upstream pipe contributing to the upstream node of the unknown pipe. Additionally, within the Washington Park study area there was one instance which indicated a pipe with an unknown downstream connection. In this instance it was assumed that the pipe made its connection to the nearest downstream node.

During the site walkthrough of each study area, the locations of all inlets within the right-of-way or observed on private or public land were noted and imported into GIS. Each study area was broken into subcatchments corresponding with a single inlet, with the contributing area determined based on the topographic data obtained from USGS. This data was checked against observations made in the site walkthroughs with minor adjustments being made pursuant to topographic variations not shown in the USGS data at the resolution presented. These subcatchment divisions were then used as the modeled subcatchments in SWMM.

The subcatchment parameters in SWMM were determined according to the following general methods. The area of each subcatchment was determined by the area of the polygon created in GIS to delineate the catchment. The percent impervious area was determined through GIS analysis, identifying the overlap between each particular subcatchment polygon and the polygons created in identifying the rooftop and pervious cover areas. The rooftop and pervious cover areas were subtracted from the total catchment area to derive the street-level impervious cover. The roof and impervious cover areas for each subcatchment were then summed and divided by the total subcatchment area to arrive at the percent impervious for the given subcatchment.

For the width and percent slope parameters, the upslope boundaries relative to the subcatchment low point (located at the existing inlet in the subcatchment) were identified. Five points spaced equidistant along the upslope boundary were located. Each of these points, plus the low point, had their elevations estimated based on the USGS topographic data. The distances between each point and the low point were then measured in GIS, and in turn the slopes for each line calculated. These slopes were then averaged for the percent slope parameter of the subcatchment. The distances between each point and the low point were also averaged, and this average used to divide the total subcatchment area to arrive at the subcatchment width parameter.

Since the observed inlets were not directly modeled, stormwater leaving the subcatchment was routed to the node representing the existing manhole to which a given inlet is connected. Internal routing was set to have 100% of runoff generated from pervious surfaces routed to impervious surfaces prior to exiting the subcatchment. Depression storage on impervious surfaces was assumed to be the default value of 0.05 inches. Pervious depression storage was set to a value of 0.25 inches. The percent of impervious cover with zero depression storage was set to 0%.

Infiltration was modeled using the Horton Equation native to SWMM's modeling architecture, which uses five variable inputs: Maximum infiltration rate, minimum infiltration rate, an infiltration decay constant, a drying time, and a maximum infiltration volume. The maximum infiltration rates were derived from the averages of the first minute interval from the first falling head permeability test at all locations in the given study area. The minimum rate was taken as the average rate of all tests in each study area. The infiltration decay constant was derived for each test performed by subtracting the minimum infiltration rate from the maximum rate then dividing by fifteen minutes. The values calculated for each test in a given study area were then averaged to obtain the value used in the model, and the drying time and maximum infiltration volume parameters were kept as the default values of seven days and no volume limit, respectively.

Finally, the precipitation time series collected from the NOAA Newark Airport weather station in 2008 was utilized in this study for its proximity to Perth Amboy and completeness. The 2008 year is becoming a standard within the modeling community due to its storm distribution and total rainfall depth. A copy of the 2008 Newark Airport precipitation time series can be found in Appendix D.

Once the base model was built, a host of GI interventions were incorporated into the SWMM model to assess the change in runoff from the entire catchment. SWMM is equipped with an advanced library of GI modeling tools called LID (Low Impact Development) Controls, allowing for simulation of different GI typologies or practices including bio-retention cells, rain gardens, rain barrels, and permeable pavements.

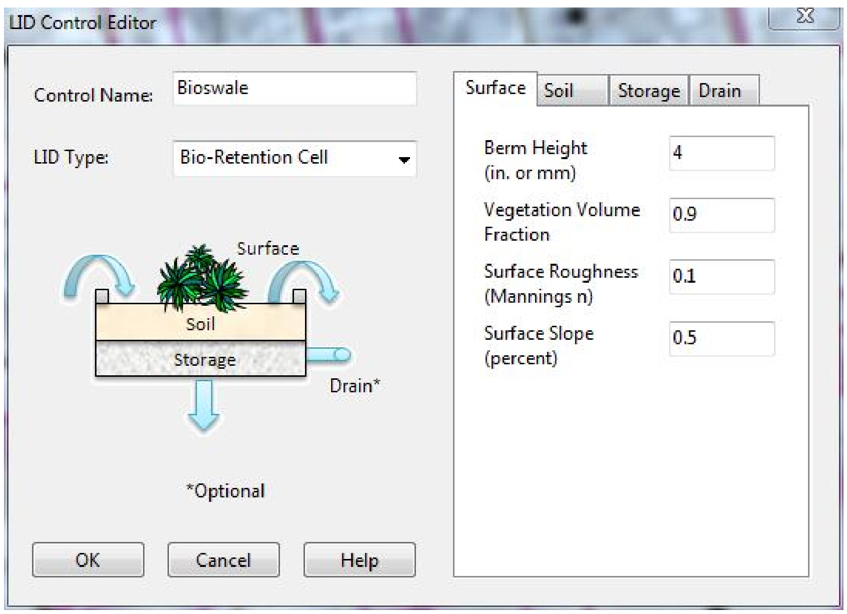


Figure 3 - SWMM LID Control Example

Most of the GI technology models were created using SWMM's LID control editor. LID type and main parameters for each GI technology are summarized in Table 2 - LID Control Summary. Parameters for each technology were derived according to meet the 1.25-inch storage target for precipitation over the catchment area. The 1.25-inch rain event is defined as the Water Quality Design Storm (WQDS) by NJDEP, and recommended for sizing GI practices in NJDEP's guidance document. It should be noted, however, that approximately 85% to 90% of precipitation events for this region are one inch or less, and so considerations can be made for the sizing of GI as it relates to a municipality's CSO reduction targets and the cost of construction.

Two additional GI technologies were created as typical SWMM storage units: sub-surface detention, sub-surface retention, and the retention/detention wetland. Sub-surface detention storage and detention ponds were modeled using similar storage tank parameters, while sub-surface retention storage were modeled as storage tanks with infiltrating bottoms.

Table 2 - LID Control Summary

GI Technology	**SWMM LID Control Type**	**Main Parameters**
Permeable Concrete	Permeable Pavement	Surface infiltration, concrete thickness, subsurface gravel & underdrain characteristics, sub-surface permeability rate
Rain Barrels	Rain Barrels	Barrel geometry, outflow rate
ROW Bioswales	Bio-Retention cell	Surface geometry, soil & gravel characteristics, sub-surface permeability rate
Rain Garden	Bio-Retention cell	Surface geometry, soil & gravel characteristics, sub-surface permeability rate
Green Roof	Green Roof	soil & drainage mat characteristics
Retention/Detention wetland	N/A	Storage capacity, volumetric infiltration rate
Sub-Surface Detention/Retention	N/A	Storage capacity, volumetric infiltration rate

In all cases for the LID controls, soil porosity was assumed to be 0.25 and gravel porosity 0.40. LID soil saturated hydraulic conductivity was assumed to be 0.5 in/hr, while gravel saturated hydraulic conductivity was assumed to be 10 in/hr. Hydraulic conductivity for infiltration out of the LID was assumed to be the average rates measured for each study area, discussed further below. Generally, a base soil depth of 18" was assumed where applicable, and the surface and gravel storage layers adjusted to meet the 1.25-inch storage target for the particular contributing area. For rain barrels, a standard 60-gallon capacity was assumed.

Once models for all GI interventions were created, they were incorporated into each subcatchment. A continuous simulation was then run using the same precipitation series as in the base model.

Findings

PERTH AMBOY'S HYDROGEOLOGIC SETTING

Based on the Geologic Map of the Surficial Geology of the Perth Amboy and Arthur Kill Quadrangles provided by the US Geological survey, The City of Perth Amboy sits atop the glacial till of the terminal moraine from the Late Wisconsonian Glaciation Period. These surface soils consist of reddish-brown clayey, silty-sand to clayey, sandy-silt. The topography is variable, forming knolls, ridges, and basins. Being classified in USDA hydrologic soil group C, these soils have a moderately high runoff potential when thoroughly wet. Depth to groundwater is anticipated to be as little as 18 inches to greater than 80 inches depending on the particular topographic setting of a site.

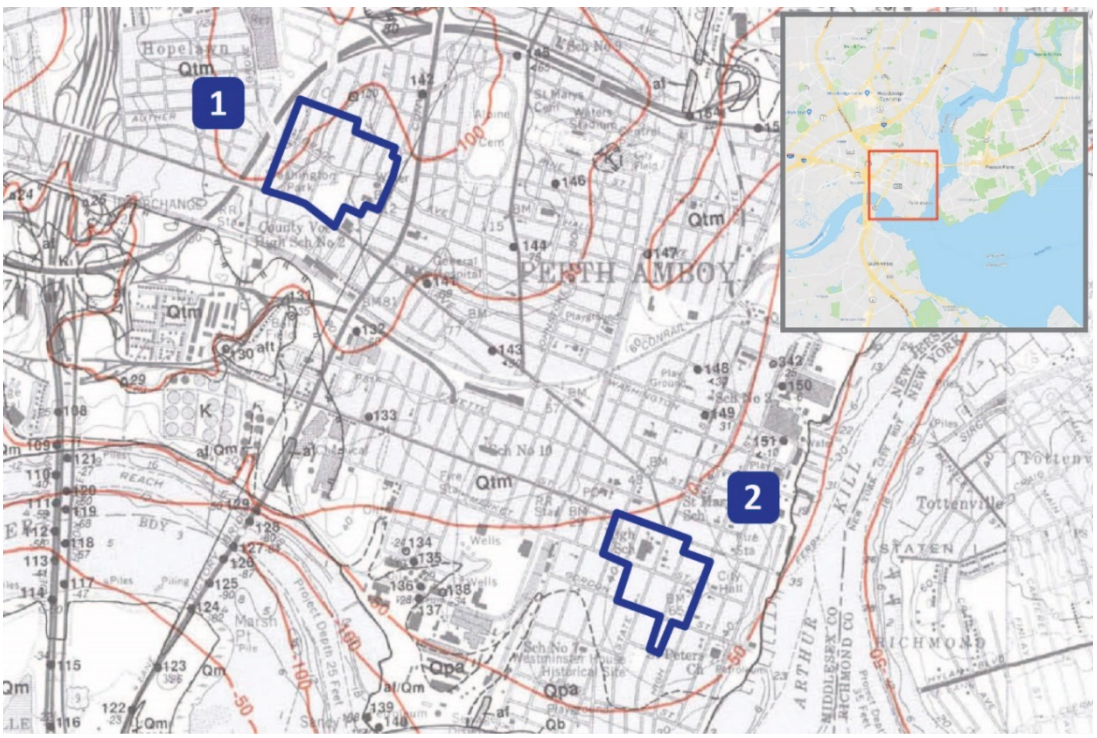


Figure 4 - USGS Soil Map with Washington Park (1) and Downtown (2) study areas

STUDY AREAS

Washington Park

The 53.8 acre Washington Park Study Area consists of the residential neighborhoods surrounding the west, north, and east sides of Washington Park, bound by New Brunswick Avenue to the south, the blocks of McKeon Street and Carlock Avenue to the west, the blocks of Bingle Street and Harrington Street to the north, and to the east Lee Avenue up to the Compton Avenue intersection where then Carson Avenue becomes the boundary. The area is zoned as R-50 – Single Family Residential – which composes the second largest zoning classification within the City of Perth Amboy, accounting for 14.6% of the City's land area. Furthermore, the similarly zoned single family designation, R-60, accounts for an additional 9.9% of Perth Amboy's land area and, taken together with R-50, these single-family residential typographies account for nearly 25% of the city's land cover. The surface cover analysis revealed that impervious surfaces (roofs, streets, sidewalks, and other paved areas) account for 70% of the total study area. Topographically, the low point of the study area is located on New Brunswick Avenue adjacent to Washington Park at the approximate address of 685 New Brunswick Avenue, across the street from the Spring Cove apartment complex parking lot. Slopes range from zero to eight percent, with the surrounding area sloping downward toward the area low point from the east, north, and west.

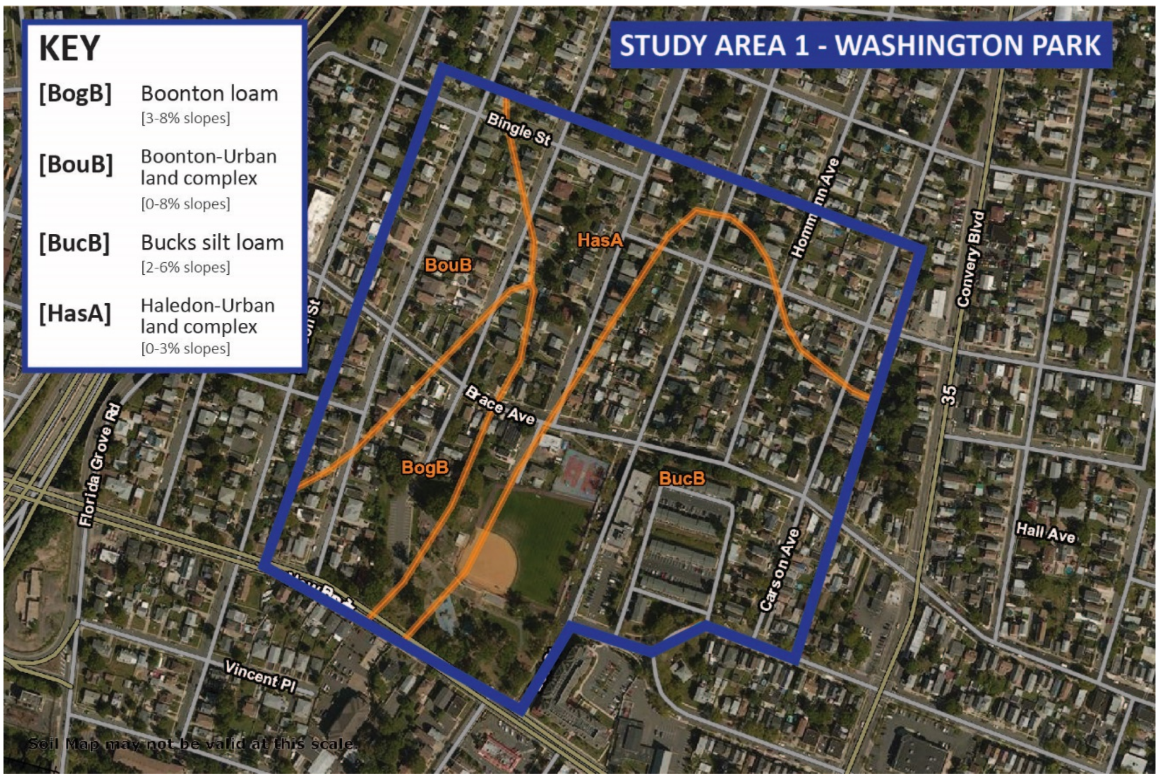


Figure 5 - Natural Resources Conservation Service (NRCS) Soil Survey of Study Area 1, Washington Park

There are no existing water bodies within this study area. However, stakeholder testimony, corroborated by historic maps of the area, indicates that a natural spring was present just south of the area low point on the other side of New Brunswick Avenue. A map of the city dating from 1872 shows a stream was present with the headwater beginning at this location, then flowing south to the Raritan River. An earlier map of Middlesex County dating from 1861 indicates that this stream may have begun further to the north beyond New Brunswick Avenue. A third map dating from 1914 no longer locates this stream, likely having been filled for development at some point prior.

Figure 6 - Historic stream locations in Study Area 1, Washington Park

Also reported by project stakeholders was the common occurrence of nuisance flooding on New Brunswick Avenue at the low point described above. The flooding develops during rain events and, depending on the depth and intensity of precipitation, can reach depths up to two to three feet. It was further reported that this flooding had not been a problem prior to recent development in the area south of the study area low point on New Brunswick Avenue. It is not clear what the primary cause of the flooding is in this case, however the recorded presence of an historic stream suggests a sizeable contributing area and shallow depths to groundwater. A soil map of the area provided by the USDA Natural Resource Conservation Service further points to the possibility of a groundwater flow path related to the historic stream with the presence of the soil map unit, Haledon-Urban Land Complex, bisecting the site north to south through the low point. This soil map unit is characterized by a shallow expected depth to groundwater of 6 to 18 inches below the surface. Other soil map units in the study area include Boonton Loam, Boonton-Urban Land Complex, and Bucks Silt Loam, which all correspond with the broader characterization of terminal moraine glacial till by the USGS geologic map.

A site walkthrough was conducted in April, 2017, to verify the background information collected, identify additional infrastructure not included in the sewer characterization map, and begin to identify potential locations for GI. In this walkthrough it was determined that the topographic information obtained for the site agreed with the conditions found on the ground. Additional information pertaining to the locations of local high and low points within the right-of-way was collected. And related to this, existing stormwater inlet locations were noted for later mapping in GIS. There were no major differences between the collected orthophoto images and the locations of transportation infrastructure, existing buildings, playground infrastructure or mature trees.

Initial GI opportunities identified in this area fell into two general categories: (1) distributed upslope GI located in the residential neighborhood surrounding Washington Park and (2) centralized downslope infrastructure taking advantage of the open space and relative low-point of Washington Park itself. The upslope infrastructure consists of:

- Right-of-way bioswales intercepting runoff before entering roadway inlets;
- Rain barrels managing roof runoff from residential properties; and,
- A green roof retrofit and/or the creation of a rain garden facility on the County-owned George J. Otlowski, Sr. Center for Mental Health Care managing direct precipitation.

The downslope infrastructure consists of:

- A sub-surface retention retrofit of the basketball courts and the northeast corner of Washington Park, managing direct precipitation and runoff from the upslope rights-of-way of adjacent Lee Street and Brace Avenue; and
- A retention/detention wetland in the southeastern portion of the park, managing water from the park's parking lot and upslope Raritan Ave.

A soil investigation was conducted in July, 2017. A total of six locations were bored throughout the study area according to the methodology outlined in the Methodology section, with a sample taken from the deepest one foot interval at each point.

Figure 7 - Soil sample test sites for Study Area 1, Washington Park

The typical soils encountered consisted of reddish-brown clayey, silty sands with some gravel. Lenses of dense clay were also encountered. USCS field classification of soils logged indicated that the most common soil types encountered were fine sands with silt and clay (ML) and well graded, silty sands (SW-SM). Laboratory mechanical analyses indicated that the six soil samples taken had the following ranges in composition:

Sand:	54%-72%	Average:	61%
Silt:	11%-23%	Average:	16%
Clay:	17%-29%	Average:	23%

The typical laboratory classification for these samples was sandy clay loam and sandy loam. Groundwater was encountered at a single location in Washington Park at a depth of 4'-4" below the surface. During the soil investigation, a number of residents inquired about the activities being performed. Engagement with residents was used as an opportunity for informal interviews about existing drainage issues or concerns related to private property, specifically basements. Through these interviews it was found that it was common for households to be equipped with basement sump pumps to remove accumulated groundwater.

Permeability testing took place in August, 2017, performed according to the method outlined in the Methodology section above. Two locations were chosen, one where sandy clay loam was sampled and one where sandy loam was sampled. The measured infiltration rate for sandy clay loam was 0.090 in/hr and the measured rate for sandy loam was 0.120 in/hr. These measurements were the basis for the average rate used for modeling: 0.105 in/hr. This rate is considered low for infiltration-based GI but within an acceptable range.

Downtown

The 43.6 acre Downtown Study Area consists of two general typologies: a commercial district to the north and a medium-density residential district to the south. The area is bound by Smith Street to the north, High Street to the east, Gordon Street to the south with a further extension down Kearny Avenue to Harrison Place, and McClellan Street between Smith and Market with Brighton Avenue between Market and Gordon creating the western boundary. The commercial area accounts for 54% of the total study area, with zoning designations C-2 (34% of total study area) at the northeast and S-2B (20% of total study area) at the northwest. The residential area accounts for 46% of the total study area, being zoned as R-25 (16% of total study area) at the southwest and R-60 (30% of total study area) at the southeast.

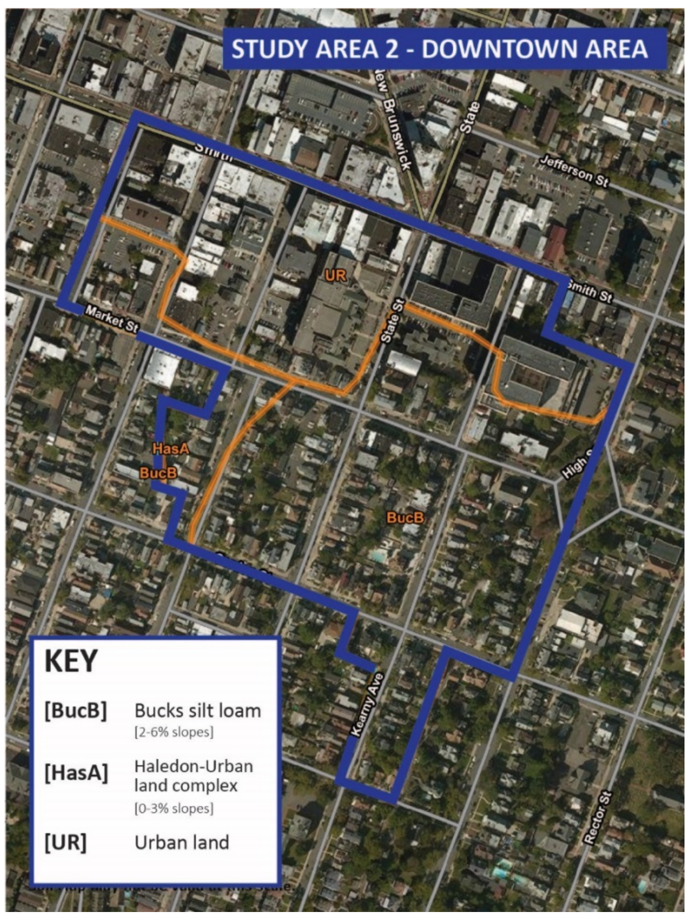


Figure 8 - Natural Resources Conservation Service (NRCS) Soil Survey of Study Area 2, Downtown area

Boundaries for all four of these zones meet at the intersection of Market Street and State Street. The surface cover analysis revealed that impervious surfaces (roofs, streets, sidewalks, and other paved areas) account for 90% of the total study area. Topographically, the study area is relatively flat with a slight high point on High Street roughly half way between Market Street and Gordon Street. Slopes range from 0% to 5% with the majority being in the 0% to 2% range.

There are no existing water bodies in this study area. The earliest of the historic maps obtained for this study, dating from 1861, indicates a channel in the vicinity of what is now McClellan Street, most likely situated west of the street line. This channel connected with at least three ponds further to the west of the study area, and appears to have been culverted under Market Street to drain to the south. Furthermore, the headwater for a stream is also shown on the 1861 map beginning on the opposite side of Market Street to the southeast of where the culvert is marked. This stream is shown to flow south-southwest away from the study area. All other maps obtained show that this area had been fully developed, with the above mentioned channel and ponds being filled prior to 1876. This likely coincided with the development of what was originally known as the Perth Amboy and Elizabethport Rail Road line, now owned by New Jersey Transit servicing its North Jersey Coast line. A soil map of the area provided by the USDA Natural Resource Conservation Service indicates the presence of three soil map units within the study area: Urban Land (37% of total study area), Bucks Silt Loam (52% of total study

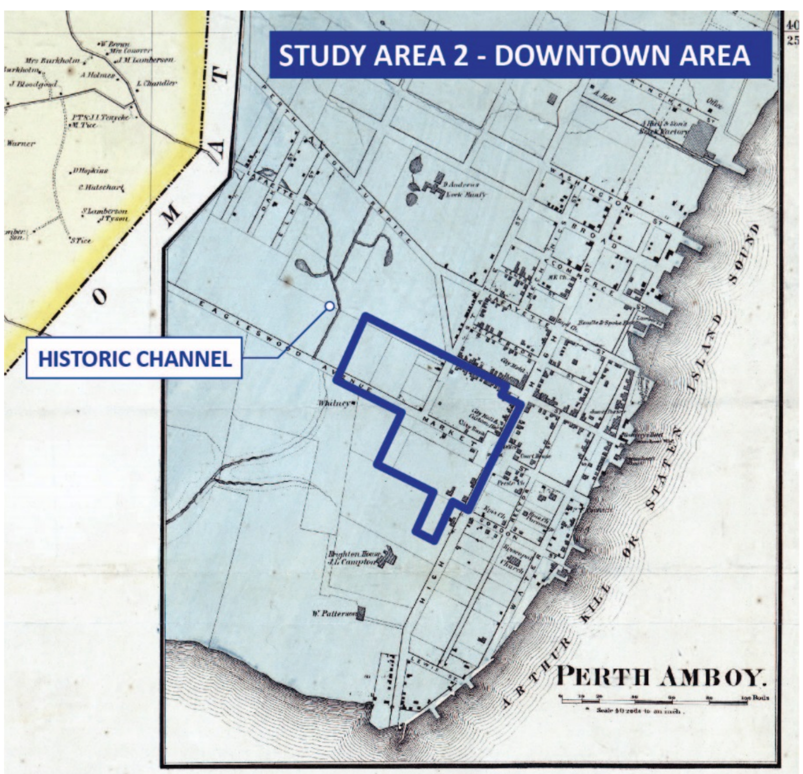


Figure 9 - Historic stream locations in Study Area 2, Downtown area

area), and Haledon-Urban Land Complex (11% of total study area). Both urban land units have very high runoff potential with shallow depth to groundwater (6-18 inches) expected within the Haledon complex. As a whole, Urban Land is the largest soil map unit for all CSS communities in New Jersey, accounting for 20% of total area. The five largest soil map units are summarized in Table 3. The presence of the Haledon complex in the southwest portion of the site also corresponds with the possible location of the historic stream mentioned earlier. The Bucks Silt Loam expected in the southeast portion of the study area corresponds with the broader characterization of terminal moraine glacial till by the USGS Geologic Map.

Table 3 - Five Most Common Soil Map Units for NJ CSS Communities

Map Unit Name	Runoff Class	% of CSS Communities
Urban Land	Very High	20%
Urban land, till substratum, 0 to 8 percent slopes	Very High	11%
Urban land, wet substratum, 0 to 8 percent slopes	Very High	9%
Urban land, Boonton substratum - Boonton complex, red sandstone lowland, 0 to 8 percent slopes	Medium	6%
Urban land, Bigapple substratum, 0 to 8 percent slopes	n/a	5%

A site walkthrough was conducted in April, 2017, to verify the background information collected, identify additional infrastructure not included in the sewer characterization map, and begin to identify potential locations for GI. In this walkthrough it was determined that the topographic information obtained for the site agreed with the conditions found on the ground. Additional information pertaining to the locations of local high and low points within the right-of-way was collected. Existing stormwater inlet locations were noted for mapping in GIS. There were no major differences between the collected orthophoto images and the locations of transportation infrastructure, existing buildings, playground infrastructure, or mature trees.

Because of the relative flatness of the study area coupled with challenges for locating real estate for GI in an urban landscape, the initial GI opportunities identified during the walkthrough consisted of smaller scale, distributed interventions:

- Right-of-way bioswales intercepting runoff before entering roadway inlets;
- Rain barrels managing runoff from residential homes; and,
- Permeable pavement parking lots managing direct precipitation and, where possible, adjacent roof runoff.

- Stormwater planters managing roof runoff collected in building downspouts.

A soil investigation was conducted in July, 2017. A total of six locations were bored throughout the study area, with a sample taken from the deepest one-foot interval at each point as outlined in the methodology section of this document. Soils encountered were variable, consisting primarily of reddish-brown clayey, silty sands (ML); yellow-brown silty sands with traces of clay (SW-SM); and pockets of grey clay (CL). The variability of the soils encountered was indicative of historic filling activities, which is also indicated by brick fragments being common within bored soil. In most cases, the clay lenses encountered were in the 2-4 foot range. At locations where clay was encountered, soil above the clay was typically saturated and underlying soils were unsaturated, indicating that perched groundwater is a common occurrence in the study area. The laboratory mechanical analysis indicated that the six soil samples taken had the following ranges in composition:

Sand:	61%-78%	Average:	69.5%
Silt:	10%-16%	Average:	12.8%
Clay:	9%-16%	Average:	17.7%

The classifications for the samples were sandy loam and sandy clay loam. As mentioned previously, perched groundwater was encountered at two locations with unsaturated soils encountered below the confining layer in both cases. Groundwater was also encountered at two additional locations where a confining layer was present in the final interval of the boring (4'-5'). Given the perched groundwater conditions elsewhere in the study area along with the expected depth to groundwater being greater than 80 inches as reported by the NRCS soil map for the particular location, it is likely that the deeper samples were also instances of perched groundwater.

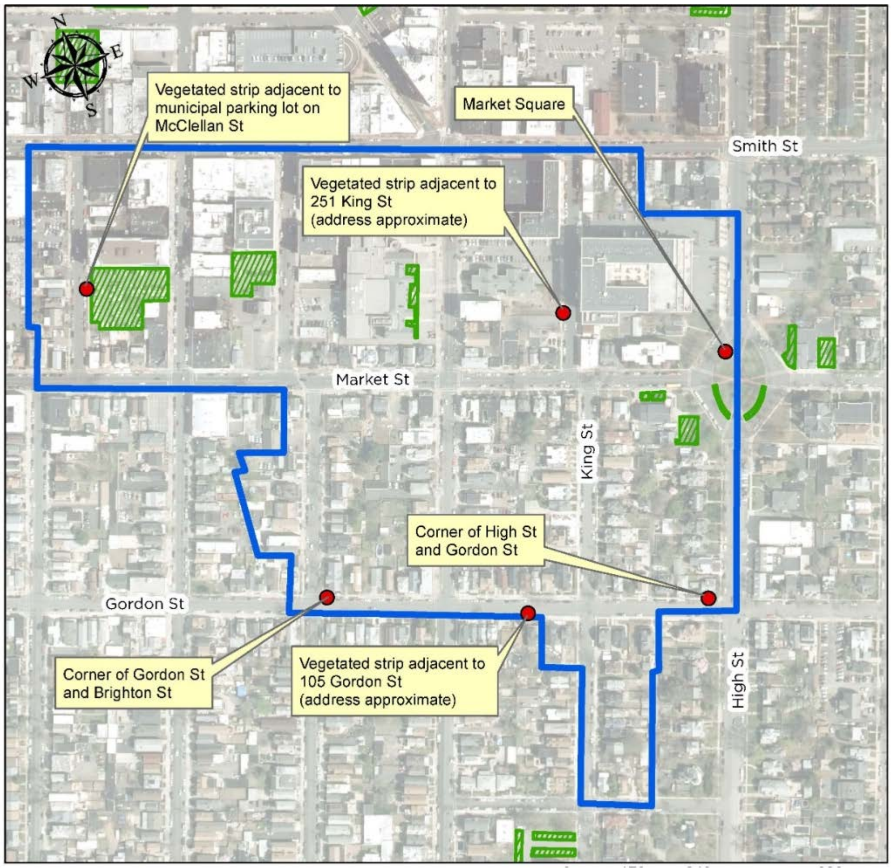


Figure 10 - Soil sample test sites for Study Area 2, Downtown area

Permeability testing took place in August, 2017, performed according to the methodology in Section 2, above. Two locations were chosen, one where sandy loam was sampled and one where sandy clay loam was sampled. The measured infiltration rate for the sandy loam was 0.21 in/hr and the measured rate for sandy clay loam was 0.0.13 in/hr. These measurements were the basis for the average rate used for modeling: 0.17 in/hr. This rate is considered low for infiltration-based GI but within an acceptable range.

SWMM MODELING RESULTS

With the collection of background and field data, SWMM models were developed to estimate the efficacy of the identified green infrastructure opportunities. The precipitation data used was collected by the National Oceanic and Atmospheric Administration (NOAA) at the Newark Airport weather station. The data was reported by depth in hourly intervals over the full 2008 year, with a total annual depth of precipitation of 48.48 inches.

The analysis was performed by comparing the total and peak flow volumes out of the sewer outfall from each study area to those parameters from the different greened scenarios, similarly to NJDEP's guidelines (NJDEP, 2018). The greened scenarios were modeled to investigate the impacts of each intervention separately along with a maximized model to investigate the potential collective impact of the GI opportunities together. Furthermore, distributed GI practices such as bioswales and rain barrels were modeled according to at least three different scenarios: full implementation, intermediate implementation, and small-scale implementation. The technical configurations for each scenario were specific to each GI technology, which is described in that section below.

Due to the field measured infiltration rates being relatively low for infiltration-based GI, it was critical to ensure that the storage volume within each GI installation was available for subsequent events. Underdrains were modeled into the infiltration-based infrastructure to slowly release detained stormwater to the existing sewer system. In all cases, these underdrains were modeled to discharge the total storage volume of the infiltration-based infrastructure within 72 hours. NJDEP's guidance document recommends a draw down between 48-72 hours (NJDEP, 2018). Further coordination can be made with the Middlesex County Sewerage Authority to refine this drawdown time, considering the time it takes where wet weather flows are diminished enough after a rain event where the treatment plant can readily accept the drawdown flow.

The numbers presented in this Section are specific to each of the study areas. For example, the 16.4% reduction in wet weather flow for the Washington Park bioswale alternative indicates a reduction in the wet weather flow generated within the Washington Park study area only. When taken against the runoff generated within the entire city of Perth Amboy, this reduction would be much lower. However, these numbers illustrate the potential for similar installations outside of the study area, such that if bioswales were implemented upstream of every inlet within the city, the expected wet weather reduction would approach the percent reduction across the entire city. Furthermore, the wet weather flow reduction should be taken as a base reduction for the amount of stormwater entering the system. Additional studies have shown that every gallon of stormwater captured by GI translates to a 0.4 to 0.7 gallon reduction in combined sewer overflow, depending on the particularities of the sewer system (NJDEP, 2018).

Each of the options presented below can be implemented independently of one another, with the exception of the different options within the tiered alternatives, such as high priority bioswale implementation versus the maximum bioswales implementation. With multiple options selected, the stormwater management benefits can be added together to estimate their combined impact.

Washington Park Study Area

Right-of-way Bioswales

Right-of-way bioswales were modeled assuming installation immediately upstream of existing right-of-way inlets within the study area. Because each inlet is associated with its own subcatchment, one bioretention cell LID control was modeled per applicable subcatchment according to the following three scenarios: full implementation with all right-of-way inlets receiving a bioswale; priority implementation with bioswales installed in the largest 50% of subcatchments by area; and high priority implementation with bioswales installed in the largest 25% of subcatcments by area. The bioswales were sized to have a footprint of 100-square feet and to manage a 1.25-inch rain event over its contributing area.

Bioswale Performance Metrics

Scenario	Portion of Study Area Managed	Estimated Annual Volume Managed	Estimated Annual Volume Retained	Reduction in Wet Weather Flow	Average Peak Flow Reduction
Full Implementation	21%	5.9 million gallons	440,000 gallons	16.4%	12.6%
Priority Implementation	13.8%	3.9 million gallons	220,000 gallons	10.8%	8.3%
High Priority Implementation	8.3%	2.4 million gallons	110,000 gallons	6.7%	5.0%

GI In Washington Park Skate Park Footprint

Given its location at a relative low point in the study area, replacing the current skate park in Washington Park with GI was identified as one option by SWIM. Construction of a new skate park as part of the new 2nd Street Park outside the study area as well as a community desire for the skate park to be removed made this a possibility. Two options for GI were modeled at this location: A complete replacement with a retention/detention stormwater wetland, or a retrofit with broken stone storage below the asphalt. The broken stone storage alternative was sized to manage the 1.25-inch storm over its contributing area, though due to the wealth of free-water storage available in a wetland, it was identified that this alternative could manage a larger storm at a negligible increase in construction cost. Therefore, the wetland alternative was sized to manage a 2-inch rain event over the contributing area. This larger volume also allowed for an increase over the standard designed retention time of 72 hours, as the minimum 1.25-inch target would become available prior to the wetland storage volume emptying completely. A 120-hour release rate was selected. This intervention can be designed as an expansion of the GI practices that have been constructed in October, 2017, adjacent to the skate park after the modeling phase of this project began, capturing runoff from a much larger catchment area than what is now being managed.

GI In Washington Park Skate Park Footprint Performance Metrics

Scenario	Portion of Study Area Managed	Estimated Annual Volume Managed	Estimated Annual Volume Retained	Reduction in Wet Weather Flow	Average Peak Flow Reduction
Retention/Detention Wetland	5%	1.4 million gallons	630,000 gallons	3.8%	3%
Sub-Surface Storage Retrofit	5%	1.6 million gallons	810,000 gallons	4.4%	3%

George J. Otlowski, Sr. Center for Mental Health Care

Three options were originally identified for the site of the George J. Otlowski, Sr. Center for Mental Health Care on Lee Avenue operated by Middlesex County: an intensive green roof retrofit, extensive green roof retrofit, and the creation of a rain garden facility on the lawn area southwest of the facility's parking lot. Both green roof options would manage direct precipitation on the building, however after ongoing discussions with stakeholders it was deemed that neither of these options was feasible. The rain garden's location, however, provides a unique opportunity to manage a roughly 3.3 acre watershed.

George J. Otlowski, Sr. Center for Mental Health Care Rain Garden Performance Metrics

Scenario	Portion of Study Area Managed	Estimated Annual Volume Managed	Estimated Annual Volume Retained	Reduction in Wet Weather Flow	Average Peak Flow Reduction
Rain Garden	6.2%	1.8 million gallons	180,000 gallons	5.0%	3.8%

Basketball Court GI Retrofit

The location of the basketball court at the southwest corner of Lee Avenue and Brace Avenue is a good opportunity for managing runoff from the upslope area of Brace Avenue to the east. Furthermore, the hydraulic loading ratio of the potential GI footprint to the estimated contributing area gives this particular intervention the potential to infiltrate 100% of the runoff captured in spite of the relatively low measured infiltration rates.

Basketball Court GI Retrofit Performance Metrics

Scenario	Portion of Study Area Managed	Estimated Annual Volume Managed	Estimated Annual Volume Retained	Reduction in Wet Weather Flow	Average Peak Flow Reduction
Sub-Surface Storage Retrofit	1.5%	430,000 gallons	430,000 gallons	1.5%	1.5%

Rain Barrels

Rain barrels were modeled according to three alternative scenarios for distribution among residential homes within the study area: 50% of homes, 25% of homes, and 25% of homes with only 10% of those receiving proper maintenance, or an effective implementation of 2.5%. Rain barrels need to be emptied after each precipitation event to create storage for a subsequent event. Because rain barrels are maintained by the property owners themselves, there is a potential gap between the number of units distributed and those that are being maintained regularly, which the third scenario was modeled to demonstrate.

Rain Barrel Performance Metrics

Scenario	Portion of Study Area Managed	Estimated Annual Volume Managed	Estimated Annual Volume Retained	Reduction in Wet Weather Flow	Average Peak Flow Reduction
50% Implementation	8.1%	576,000 gallons	576,000 gallons	1.74%	1.74%
25% Implementation	4.1%	288,000 gallons	288,000 gallons	0.87%	0.87%
25% Implementation, 10% Functioning	4.1%	31,000 gallons	31,000 gallons	0.09%	0.09%

Maximum GI implementation

For the purpose of demonstrating the greatest potential impacts that the investigated GI can have on stormwater flows, the maximum scenario was modeled to combine all of the above technologies' alternatives with the greatest management potential. These alternatives include the following: full implementation of right-of-way bioswales, the replacement of the Washington Park skate park with a retention/detention wetland, George J. Otlowski, Sr. Center for Mental Health Care rain garden, the basketball court GI retrofit, and the 50% implementation of rain barrels. Taken together, these technologies can perform as follows:

Maximum GI Implementation Performance Metrics

Scenario	Portion of Study Area Managed	Acres of Impervious Surfaces Managed	Estimated Annual Volume Managed	Estimated Annual Volume Retained	Reduction in Wet Weather Flow	Average Peak Flow Reduction
GI Combination Model	41.8%	17.32	10.3 million gallons	2.4 million gallons	29%	23%

New Brunswick Avenue Flood Abatement

As mentioned in the introduction of the Washington Park Study Area, the low point on New Brunswick Avenue adjacent to Washington Park experiences frequent nuisance flooding during and after precipitation events. A cursory effort was performed as a part of this study to estimate the magnitude of flood reduction at this location, however due to the number of unknown variables potentially contributing to this issue it became difficult to arrive at any concrete conclusions on how GI may help mitigate it. It is recommended that further investigations be performed to identify the precise sources of the flooding so that adequate solutions can be identified.

If this issue is largely driven by surface runoff within the Washington Park sewershed examined in this study, the introduction of GI in this landscape will have a mitigating effect. Under this assumption, any runoff retained or detained which normally finds its way to the flood will no longer contribute to this effect. Smaller, more frequent precipitation events will have their associated nuisance flooding reduced. However, larger storms exceeding the capacity of GI would likely still see flooding at similar magnitudes to what occurs today. However again, it must be stressed that these potential impacts GI might have on the New Brunswick Avenue flooding are contingent on the problem being due to localized surface runoff collecting at this location. No guarantee can be made that any effect on this flooding will be had without a more comprehensive understanding of the nature of the flooding itself.

Downtown Study Area

Right-Of-Way Bioswales

In the same way as the Washington Park study area, right-of-way bioswales were modeled assuming installation immediately upstream of existing right-of-way inlets within the study area. Because each inlet is associated with its own subcatchment, one bioretention cell LID control was modeled per applicable subcatchment according to the following three scenarios: full implementation with all right-of-way inlets receiving a bioswale; priority implementation with bioswales installed in the largest 50% of subcatchments by area; and high priority implementation with bioswales installed in the largest 25% of subcatchments by area. The bioswales were sized to have a footprint of 100-square feet and to manage a 1.25-inch rain event over its contributing area.

Bioswale Performance Metrics

Scenario	Portion of Study Area Managed	Estimated Annual Volume Managed	Estimated Annual Volume Retained	Reduction in Wet Weather Flow	Average Peak Flow Reduction
Full Implementation	26%	9.3 million gallons	725,000 gallons	19.1%	17.0%
Priority Implementation	13.8%	5.7 million gallons	372,000 gallons	11.7%	10.4%
High Priority Implementation	8.3%	3.3 million gallons	186,000 gallons	6.8%	6.0%

Permeable Pavement Parking Lot Retrofit

In the initial phase of this project there were two municipal parking lots identified in this study area that could be retrofit with permeable pavement and sub-surface storage. Since that time, one of these lots, the one situated between Madison Avenue and McClellan Street, had permeable pavement installed in October 2017. Subsequent modeling efforts therefore only investigated the second lot identified which is situated on Hobart Street adjacent to the rear of McGinnis Middle School. Two scenarios were investigated for this lot. The first was assumed to manage only direct precipitation onto the lot itself, and a second where the rear downspouts of McGinnis Middle School were diverted to discharge into the storage layer below the permeable pavement.

Hobart Street Pervious Pavement Performance Metrics

Scenario	Portion of Study Area Managed	Estimated Annual Volume Managed	Estimated Annual Volume Retained	Reduction in Wet Weather Flow	Average Peak Flow Reduction
Direct Precipitation Only	0.5%	180,000 gallons	180,000 gallons	0.4%	0.5%
McGinnis Middle School Contribution	0.9%	376,000 gallons	376,000 gallons	0.8%	0.9%

Market Square GI retrofit

Through the iterative process of discussing intermediate modeling results with project stakeholders, the opportunity was found to create GI within Market Square. While this location is a historic area and surface expression GI was deemed infeasible, the creation of sub-surface storage below the existing walkways in market square was found to be suitable. This alternative manages stormwater runoff from the right-of-way upslope of Market Square primarily from the south and west.

Market Square Sub-Surface Storage Performance Metrics

Scenario	Portion of Study Area Managed	Estimated Annual Volume Managed	Estimated Annual Volume Retained	Reduction in Wet Weather Flow	Average Peak Flow Reduction
Permeable Pavers And Sub-Surface Storage	5.1%	1.8 million gallons	890,000 gallons	3.7%	1.9%

Rain Barrels

Similar to the Washington Park study area, rain barrels were modeled according to three alternative scenarios for distribution among residential homes within the study area: 50% of homes, 25% of homes, and 25% of homes with 10% of those receiving proper maintenance, an effective implementation of 2.5%.

Rain Barrel Performance Metrics

Scenario	Portion of Study Area Managed	Estimated Annual Volume Managed	Estimated Annual Volume Retained	Reduction in Wet Weather Flow	Average Peak Flow Reduction
50% Implementation	10.1%	231,000 gallons	231,000 gallons	0.5%	0.4%
25% Implementation	5.1%	84,000 gallons	84,000 gallons	0.2%	0.2%
25% Implementation, 10% Functioning	5.1%	9,000 gallons	9,000 gallons	negligible	negligible

Maximum GI implementation

For the purpose of demonstrating the greatest potential impacts that the investigated GI can have on stormwater flows, the maximum scenario was modeled to combine all of the above technologies' alternatives with the greatest management potential. These alternatives include the following: full implementation of right-of-way bioswales, the Hobart Street municipal lot pervious pavement retrofit with contribution from McGinnis Middle School, the Market Square Sub-surface storage retrofit, and the 50% implementation of rain barrels. Taken together, these technologies can perform as follows:

Maximum GI Implementation Performance Metrics

Scenario	Portion of Study Area Managed	Acres of Impervious Surfaces Managed	Estimated Annual Volume Managed	Estimated Annual Volume Retained	Reduction in Wet Weather Flow	Average Peak Flow Reduction
GI Combination Model	42.1%	16.52	11.7 million gallons	2.2 million gallons	24.1%	20.2%

Conclusions & Recommendations

As demonstrated by the modeling results, the introduction of green infrastructure into Perth Amboy's future development can have a sizeable impact in reducing the stormwater burden on the combined sewer system. This in turn will reduce the frequency and volume of CSOs, improving water quality in the Raritan River, Arthur Kill, and the Raritan Bay, as well as reduce the total quantity of wastewater processed each year by the Middlesex County Utility Authority's wastewater treatment plant servicing the city. The water quality improvements brought by the reduction in CSOs will also help to improve the habitat quality of Perth Amboy's surrounding wetlands and waterfronts through the reduction of nutrients, pathogens, and contaminants such as plastic, heavy metals, oils, and detergents. Furthermore, there is potential for GI to help in mitigating nuisance flooding, however the potential benefit is highly dependent on specific site conditions.

Because of the relative abundance of soil with a high content of fines (silt and clay) in Perth Amboy, precautions should be taken to ensure the optimal performance of infiltration-based GI. The first consideration to be made, as demonstrated by the basketball court GI retrofit and the Hobart Street municipal parking lot permeable pavement retrofit, is the hydraulic loading ratio (HLR) for GI – the ratio of the contributing impervious area to the area of the green infrastructure footprint. Where soil testing indicates low infiltration rates, reducing the HLR can allow a greater amount of captured stormwater to be infiltrated. This, however, will require a larger footprint for GI to manage the totality of Perth Amboy's impervious surfaces. A cursory analysis using the data collected for this study indicates that an HLR up to 6:1 will infiltrate 100% of the design storm (1.25 inches over 72 hours). Second, as modeled for this study, underdrains are recommended for where infiltration rates are low and the HLR is greater than 6:1, which should be designed to discharge the total storage volume of the GI within a specified amount of time. For this study, 72 hours was used.

The effectiveness and cost efficiency of GI technologies are variable and site specific, as the cost of implementation, effectiveness, particular co-benefits, and political or technical hurdles in implementation vary between different technologies and locations. The following section details the different technologies investigated for this study, identifying those with the greatest benefits, lowest cost of implementation, and a diversity of co-benefits. The cost efficiency numbers were estimated to include materials and labor. A summary of the performance and cost efficiency for each of these interventions can be found in the options matrices provided in Appendix B.

SUGGESTED GI FOR PERTH AMBOY

Bioswales

Bioswales are depressed, planted areas with porous soil and gravel layers that infiltrate and sometimes detain street runoff. Bioswales are a common form of GI in urban areas because they are constructed entirely within the public right of way and manage a large source of urban runoff—streets.

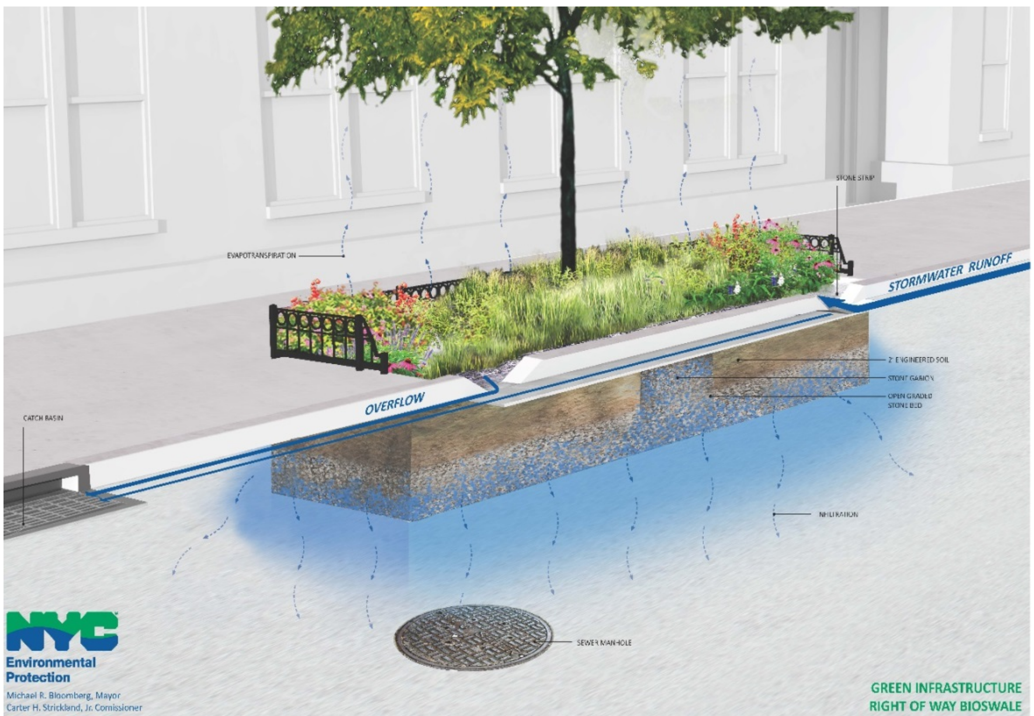


Figure 11 - Conceptual Design of a standard NYC DEP ROWB

Engineering Performance and Cost Efficiency

Bioswales look much like a standard planted area or tree pit but lie below the roadway grade and include layers of soil and gravel that allow for storage and infiltration of stormwater. Any runoff that surpasses the collection capacity of the bioswale bypasses the bioswale and is subsequently captured at a conventional stormwater inlet and directed to the sewer system. An ideal bioswale is located on the sidewalk, contains a tree, and stormwater is conveyed through an engineered curb-cut inlet. This analysis assumes that the bioswales will be located between the edge of the roadway and the property line in a strip of existing sidewalk directly upstream of existing stormwater inlets. However, numerous siting guidelines must be met to ensure safe, effective bioswale placement. If placement is not possible in the sidewalk due to technical or programming issues, the bioswale can be moved to within the existing roadway or under the roadway with no surface expression.

For this report, three bioswale scenarios were modeled. All locations directly upstream were considered as candidate sites. The model looked at different implementation rates of these sites, prioritizing those with the highest hydraulic loading rate (stormwater capture). The first scenario assumed 100% implementation, with a bioswale being constructed upstream of every inlet. The second scenario took the 50% of sites with the highest loading rate; and the third scenario looked at the top 25% of hydraulic loading rate sites. Using these parameters resulted in a hydraulic loading ratio range from 50:1 to 120:1, or in other words each bioswale manages an area between 5,000 and 12,000 square feet. This was determined by the existing contributing areas to each inlet associated with each bioswale. The performance of a bioswale can be improved by limiting this ratio which can be accomplished by introducing additional bioswales for inlets with larger contributing areas.

Bioswale construction for the Perth Amboy area is estimated to be $20,000 to $25,000 per bioswale, with the cost efficiency dependent on the size of the particular catchment managed for a given bioswale. Pursuing high-priority locations with the largest catchment areas, it is estimated that the cost of implementation would be $300,000 to $375,000 in the Washington Park study area and $200,000 to $250,000 in the Downtown study area. Annual maintenance is estimated to be on the order $300 to $600 per year, per bioswale. The total implementation, annual maintenance, and projected dollar per gallon of stormwater managed (cost efficiency) are reported in the table below.

Scenario	Number of Bioswales	Construction Cost	Annual Maintenance Cost	Dollar per Gallon of Annual Runoff Managed	Projected 5-Year Dollar per Gallon of Runoff Managed
Washington Park					
Full Implementation	60	$1.2 million - $1.5 million	$17,400 - $34,800	$0.24 - $0.30	$0.05 - $0.07
Priority Implementation	30	$600,000 - $750,000	$8,700 - $17,400	$0.18 - $0.23	$0.04 - $0.05
High Priority Implementation	15	$300,000 - $375,000	$4,300 - $8,700	$0.15 – $0.19	$0.03 - $0.04
Downtown					
Full Implementation	39	$780,000 - $975,000	$11,000 - $22,600	$0.08 - $0.10	$0.02
Priority Implementation	20	$400,000 - $500,000	$5,800 - $11,600	$0.07 - $0.09	$0.02
High Priority Implementation	10	$200,000 - $250,000	$2,900 - $5,800	$0.06 – $0.08	$0.01 – $0.02

Co-Benefits

Increases Groundwater Recharge

By directing rainwater into the ground through infiltration, bioswales have the potential to increase groundwater recharge, which provides benefits such as natural water filtration and the revitalization of groundwater driven ecosystems.

Improvement of Air Quality

Bioswales, like other vegetated GI practices, can improve air quality through uptake of air pollutants and the deposition of particulate matter. Leaves of trees and shrubs uptake ozone through stomata respiration. Once inside the leaf, ozone diffuses into intercellular spaces and reacts with inner-leaf surfaces (Nowak et al., 2006). Additional ozone and particulate matter are removed from the air by direct interaction with the surface area of the bioswale plantings. Although some particles are absorbed into the leaves, most particles are retained on the surface of the leaf, with 50% assumed to be re-released to the atmosphere. The remainder is washed off during rain events, or deposited during leaf die off, effectively removing the particulate matter from the air (Stratus, 2009).

Reduction of Atmospheric CO2 and Energy Reduction

Bioswales can reduce carbon dioxide emissions through direct carbon sequestration and energy reduction. Vegetative plantings capture atmospheric carbon dioxide and transform it into components necessary for plant survival through photosynthesis. By reducing the volume of stormwater runoff to grey infrastructure, bioswales also reduce the quantity of energy used for wastewater pumping and treatment. If a bioswale provides shading and temperature reductions, it can help lower energy spent on cooling.

Community Greening and Aesthetics

When well-maintained and functional, bioswales improve local aesthetics and enhance green spaces within communities. Access to green space and views of nature are considered valuable in both residential and commercial settings. There is also potential for these practices to help reduce noise transmission through sound adsorption and to improve social networks in neighborhoods.

Increases in greening and aesthetics can translate into monetary benefits. Philadelphia's Triple-Bottom-Line Analysis of Alternative CSO Control Policies (Stratus, 2009) linked GI improvements and an increase in residential property values. Studies have also shown urban plantings decrease crime rates and contribute to public safety.

Habitat Creation

Bioswales, through increased vegetation, provide habitat for a wide variety of flora and fauna. A bioswale's habitat value is best maximized when planted with native species. Bioswales can act as living spaces for both resident and migratory species (Center for Neighborhood Technology, 2010).

Reduction of Urban Heat Island Effect

Bioswales, especially those containing trees, create shade, reduce the amount of heat absorbing material, and emit water vapor - all of which cool hot air and reduce the urban heat island (UHI) effect. In addition to reducing surface air temperature, trees can also directly reduce energy demand through shading windows and built surfaces (Rozenzweig et al., 2009).

Reduction of the UHI effect has been of increasing importance as extreme heat events continue to rise in frequency and often have detrimental public health consequences. Implementing heat island reduction strategies will continue to benefit communities in overall health and productivity as climate change increases warming.

Impact on New Brunswick Avenue Nuisance Flooding

The precipitation driven flooding on New Brunswick Avenue where it borders Washington Park has been a persistent problem for the City of Perth Amboy. The location at which the flooding is concentrated is at a low point relative to Washington Park to the north and a stretch of New Brunswick Ave to the east and west. Furthermore, a trunk sewer line runs through this location roughly from the north to the south, and an historic stream formerly flowed in the same direction, as noted in the Washington Park study area description section above. Because the implementation of bioswales throughout the Washington Park study area has the potential for the greatest amount of stormwater to be managed, any potential reduction in this nuisance flooding through GI will most likely be realized through these efforts.

The tributary drainage area to the location of the flooding extends beyond the boundaries of the Washington Park study area and determination of the precise cause of the flooding is not within the scope of this document. Therefore, providing precise figures on flood reduction through the use of GI is not feasible for this report. However, the capture of stormwater upstream of the flooding will help to mitigate the magnitude of water reaching this location, particularly for smaller precipitation events. It is entirely possible that this reduction will be imperceptible if the mitigation efforts are limited to within the study area of this report. All contributing factors to the flooding would need to be determined to develop a comprehensive flooding solution.

Maintenance

Like all infrastructure, GI facilities need regular maintenance to continue to operate effectively. Maintenance tasks for bioswales are categorized into short-term maintenance tasks (i.e. weekly) and long-term maintenance tasks (annually). Some tasks (i.e. inlet maintenance) require trained specialists, while other tasks (plant and tree maintenance) can be readily undertaken by environmental stewards in the community.

Short-term maintenance tasks for bioswales include plant upkeep: Watering and weeding. General inspection should be made for invasive plants, plant health, excessive sediment, and movement of sediment in the bioswale. Attempts should be made to keep the soil grading in the bioswale as designed to promote infiltration capacity. All debris and trash should be regularly removed from the planted area, gutter, and inlet.

Long-term maintenance tasks for bioswales can include seasonal tasks such as pruning during the dormant season to improve plant health. All lost vegetation should be replanted, and any damaged or missing materials should be replaced. Each year, all structural components should be inspected for cracking, subsidence, spalling, and deterioration. Every three years testing the soil to ensure proper nutrient content and to spot any irregularities caused by potential contamination or operational error can be conducted.

Bioswale maintenance activities can be completed through a variety of potential partnerships and arrangements. Green jobs and citizens programs, wherein local residents regularly monitor the soil and plant conditions, prune plants, remove trash, and otherwise maintain the bioswale, can provide job training skills and reduce maintenance burdens on the public utility. Establishing maintenance contracts with local community organizations formalizes the maintenance tasks for the bioswale system.

For bioswale maintenance tasks that are beyond the capacity of community organizations and volunteers, the City of Perth Amboy needs to determine if the bioswale inspection and maintenance can be accomplished with existing staff, if additional staff needs to be hired, if specialized training is needed, or if it would be more cost-effective to hire an experienced contractor. Decision-makers should consider which municipal departments have the equipment and skills to inspect and maintain bioswales, such as parks or public works (Center for Neighborhood Technology, 2010). Furthermore, there are existing programs in the State, such as the partnership between The Passaic Valley Sewerage Commission and Rutgers University[2], which provides annual training on GI maintenance practices. Additional programs have also been conducted by the Rutgers University Water Resources Program.

Implementation

Within this report, bioswales were sited immediately upstream of existing catch basins to maximize stormwater collection. For actual siting and implementation, there are several investigations and considerations to have in mind. Both a desktop analysis and field reconnaissance are necessary to verify key issues that influence bioswale implementation and design. A thorough review of recommended sites should be completed in an early stage of the planning process.

The level of adherence to engineering criteria for final site selection is extremely important. Strict requirements for criteria such as permeability rates and soil texture will

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[2] See http://water.rutgers.edu/PVSC/PVSC.html for more information on this maintenance training program.

lead to identified reduction in eligible sites. A more adaptable approach to engineering design will lead to more eligible locations and more stormwater being managed.

Finally, public engagement and buy-in is important for the successful implementation of right-of-way bioswales. A robust public engagement program which encourages stakeholder input will limit the opposition to bioswale construction from property owners and residents.

Physical

To ensure functionality of bioswales, safety of residents, pedestrians and drivers, and to protect existing infrastructure and property, site assessments should examine the physical surroundings of a proposed bioswale. A bioswale should be away from any existing underground infrastructure and utilities, basements, and vaults to prevent damage and flooding. Overhead wires should be avoided to prevent inference during construction and soil investigation. These features can be determined using GIS, ground penetrating radar, utility mark outs, and during a site walkthrough.

A site walkthrough of potential bioswale locations will identify any streetscaping, above ground infrastructure, and physical features that may be affected by construction of a bioswale. Bioswales must be placed away from entrances of buildings and allow a sufficient clear pathway for pedestrians. It is important to consider a bioswale proximity to trees as excavation can disrupt the tree's root structure and ultimately, its survival. When considering placement of new trees within a potential bioswale, line of site requirements should be implemented to ensure driver and pedestrian safety.

When placing a bioswale, avoid active programmatic right of way areas. These areas include bus stops, school and church entrances and exits, and fire lanes. A bioswale should not block pedestrian walkways or ramps, but can be configured to enhance pedestrian safety when designed as "bump outs" at street crossings which shorten the length of crosswalks. The ideal placement of a bioswale will enhance the current landscape without interfering with functionality.

Geophysical

Following the identification of the physical limitations to recommended bioswales, an underground geophysical investigation should be completed. As stated in the New Jersey Stormwater Best Management Practices Manual, infiltration practices must have a distance two feet from the bottom elevation of the seasonal high water table (SHWT) or bedrock. In the case of a bioswale with an underdrain, there must be a distance of one foot from the bottom elevation to the SHWT.

Soil infiltration potential is important for designing and locating bioswale practices. A soil boring will provide understand of permeability rates, hydrologic soil groups, and grain size. Locations with the best soil infiltration potential will yield the most volume reduction to the combined sewer. Due to the underdrain design of the sited bioswales, poor soil infiltration rates can be accommodated. An underdrain system will ensure water can leave the system during high rain events and times of impeded infiltration, avoiding failed systems and accumulation of standing water.

Site soil contamination should be considered when placing any infiltration-based GI practice. An increase in infiltration volume from a bioswale can expedite the transport of contaminants and interfere with remedial activity. It is possible to implement infiltration GI on a contaminated property, but careful analysis and planning is necessary to ensure that remediation and stormwater goals align (NJDEP, 2018). Spill and plume maps are available that indicate extents of known contamination and should be consulted during the planning process.

Priority Selection

For the modeling effort, initial bioswale locations were placed next to existing inlets with the intention of targeting a large area of impervious surface, since the larger the collection area, the greater the potential for stormwater volume reduction and pollutant removal. However, it is expected that some of the initial locations will need to be dismissed due to the aforementioned restrictions. A full GIS analysis of catchment areas, roadway slopes, and topographic features (which dictate the direction of stormwater runoff) should be conducted to prioritize bioswale sites with the greatest capture.

Community Programming Concerns

During initial community meetings, concern was expressed over the loss of sidewalk and easement area due to construction of bioswales. The narrow width of sidewalks in residential Perth Amboy neighborhoods limits the number of standard 5-foot wide bioswales that could be placed while still providing a safe pedestrian clearway. Alternatively, the idea of placing the bioswale within the roadway, as opposed to the sidewalk (i.e. bumpouts), would be amenable to pedestrians but reduces available parking. To work with both driver and pedestrian needs, the design team envisions a 50/50 bioswale where a narrow (2-foot wide) planted strip is located on the sidewalk containing vegetative plantings and an option for a tree. The infiltration and storage zone, consisting of engineered soil and gravel, would be constructed under the roadway, allowing for standard infiltration potential within a smaller surface expression in the sidewalk footprint. The underground storage zone would be covered by grates and not differ in functionality from a standard parking space. A conceptual design for the bioswale can be seen above.

Treatment Wetland

Figure 12 - Treatment wetland constructed in Queens, NY

Engineering Performance and Cost Efficiency

The skate park area in Washington Park was chosen as a potential location for a treatment wetland. A treatment wetland is a constructed area that employs the natural processes of wetland vegetation and soils to collect and store water. The treatment wetland in this analysis was designed as a detention wetland in which a base water elevation is set to allow for native wetland plants to thrive, even in periods of prolonged drought. The wetland would be planted with deep water emergent wetland plants and hold a permanent pool of water controlled by a low-flow orifice. Above the low-flow orifice, an extended detention zone would allow for flooding during storms. An overflow would set the maximum storage of the wetland.

The bulk of construction costs for the wetland are related to excavation, grading, and importing clean fill for planting. Depending on the texture and nutrient content of in-situ soils, it may be possible to utilize these for planting without needing to import soil, however the textural analysis from the soil samples taken indicate that the silt and clay content is likely too high for these purposes. The efficiency of this intervention is dependent on being able to manage stormwater from the adjacent parking lot and Raritan Avenue connecting street, which can be accomplished through the retrofit of existing inlets in the parking lot with new pipe connections and/or new inlet installations at the base of Raritan Avenue. The total implementation costs are reported in the table below.

Scenario	Construction Cost	Annual Maintenance Cost	Dollar per Gallon of Annual Runoff Managed	Projected 5-year Dollar per Gallon of Runoff Managed
Wetland Creation (with Skate Park Demolition)	$250,000 - $300,000	$1,200 - $2,500	$0.13 - $0.19	$0.03 - $0.04

Co-Benefits

Improvement of Air Quality and CO_2 Reduction

Urban plantings help offset climate change by capturing atmospheric carbon dioxide in their tissue, decreasing energy used by buildings, and reducing carbon dioxide contributions from fossil fuel-based power plants. Plant leaves remove gaseous air pollution by uptake via leaf stomata, and also intercept airborne particles. Pollution removal rates differ among cities according to the amount of air pollution, length of in-leaf season, precipitation, and other meteorological variables

Community Greening and Aesthetics

Wetland systems can provide a valuable addition to the green space in a community and provide passive recreational activities.

Habitat Creation

Treatment wetlands can be a means to increasing biodiversity in urban environments where diversity and ecologically productive areas have been lost to development. Wetlands are among the most biodiverse and productive ecosystems in the world, and treatment wetlands can often mimic natural wetlands in vegetation and soils. Treatment wetland plants can provide shelter, food, and nesting areas for fauna that might be otherwise unavailable in the urban environment.

Reduction of Urban Heat Island Effect

The shading effect and evapotranspiration of vegetation within a treatment wetland cools surrounding environments and can help offset the impermeable, constructed urban environment that often stores and releases solar energy.

Maintenance

The majority of maintenance issues of the treatment wetland would take place through adaptive management. Adaptive management requires the observation of natural dynamics of the treatment wetland and its surrounding area and acts in response to these observations. An adaptive management plan for the treatment wetland should be developed prior to completion of construction; monitoring of wetland functionality should be ongoing. Expected responses to the adaptive management monitoring include removal of invasive species, trash collection, and sediment removal. Treatment wetlands are built with an area known as the forebay, where the water enters, which accumulates sediment for maintenance and removal. The micropool at the outlet of the wetland may also require periodic upkeep utilizing a cleanout. Ideally, wetland vegetation would be self-maintaining upon establishment of the plant communities, limiting the effort required to sustain performance, aesthetics, and habitat value.

The proposed location of this intervention within an existing park poses an opportunity for the training of park staff or subcontracted landscapers who currently perform maintenance. In this regard, little to no additional personnel would need to be hired for the maintenance of the wetland.

Implementation

Technical challenges are not expected from the implementation of the treatment wetland. The wetland would be lined to maintain wetland hydrology, and therefore in situ soil quality and characteristics will not influence the wetland functionality. However, political challenges could arise from the siting and construction of the wetland. The wetland would be within Washington Park and require the removal of the existing skatepark. While initial feedback from community members and officials on SWIM indicated that the creation of the a new skate Park at 2^{nd} street would mitigate user concerns and in fact address the desire of neighborhood residents, additional input should be pursued during further planning. From a permitting standpoint, the principal challenge is related to the system overflow connection to the county-owned sewer system. The Middlesex County Utilities Authority should be consulted to understand their requirements and expectations for new connections from stormwater detention facilities. In all other aspects of the treatment wetland installation, the City of Perth Amboy is the governing body.

Permeable Pavement

Figure 13 - Pervious concrete example section with sub-surface check dam for slopes

Engineering Performance

Permeable pavement consists of either a concrete or asphalt surface that allows water to infiltrate through engineered macropores. Permeable pavement is installed over gravel beds that provide storage for the water passing through the pavement. Permeable pavement is most functional in a low traffic area where heavy loads and high speeds are not encountered. For this analysis, two parking lots were chosen for permeable pavement installation, the Madison Avenue municipal lot and the Hobart Street municipal lot.

Special consideration must be taken in selecting a contractor for the installation of permeable concrete or asphalt surfaces, as hiring a firm with the proper qualifications and experience is necessary to ensure correct installation, increasing the longevity of the finished product. At the Hobart Street municipal lot, the slope must be taken into consideration for the design of the parking lot subgrade, which can be terraced to allow for runoff to be held below the surface in the upslope area of the lot.

Scenario	Construction Cost	Annual Maintenance Cost	Dollar per Gallon of Annual Runoff Managed	Projected 5-Year Dollar per Gallon of Runoff Managed
Hobart Street Municipal Lot Retrofit	$41,200 - $72,100	$950 - $1,250	$0.23 - $0.40	$0.01 - $0.09
Hobart Street Municipal Lot Retrofit with Adjacent Roof Contribution	$51,500 - $82,400	$1,000 - $13,000	$0.14 - $0.22	$0.03 - $0.05

Co-Benefits

Reduction in Energy Usage and Increased Groundwater Recharge

Like all infiltration-based GI technologies, permeable pavement directs stormwater away from sewer systems into the soil below the practice. Depending on the soil and subsurface material, stormwater may infiltrate into the groundwater below. Groundwater recharge is a vital component of the hydrologic cycle and especially important in communities which pump groundwater. Perth Amboy's main drinking water source is the Old Bridge Aquifer south of the city.

Similarly, permeable pavement's diversion of runoff away from the sewer system provides energy saving benefits. Water infiltrated through permeable pavement reduces the amount of water entering conveyance systems and treatment at wastewater facilities. This reduction in treatment reduces plant operating cost and energy needs (Center for Neighborhood Technologies, 2010).

Improvement of Air Quality

Permeable pavement increases air quality through a variety of mechanisms. The decrease in wastewater treated, as discussed above, leads to reduction in emissions from power plants through lower energy usage. The ground level ozone is decreased through the reduction in the urban heat island effect, which is a benefit of permeable pavements (Center for Neighborhood Technologies, 2010).

Reduction of Urban Heat Island Effect

Urban Heat Island Effect, in part a result from the increased temperatures from paved surfaces, has been shown to be lowered by the use of cool pavement. Cool pavements are pavement technologies that tend to store less heat and may have lower surface temperatures than standard pavement. Permeable pavement is emerging as a potential cool pavement technology (EPA, 2005).

Permeable pavements allow air, water, and water vapor into the voids of the pavements. When wet, these pavements can lower temperatures through evaporative cooling. The water passes through the voids and into the soil or supporting materials below. Moisture within the pavement structure evaporates as the surface heats, thus drawing heat out (EPA, 2005). The extent to which permeable pavements can reduce air temperatures when dry is less certain. Permeable pavements are cooler than traditional pavements due to the increased surface area exposed to air. These conditions may limit heat transfer to the lower pavement structure and soils, keeping heat at the pavement's surface (and increasing daytime surface temperatures), but reducing bulk heat storage (reducing release of heat at night) (Haselbach, 2008 and Kevern et al, 2008). The increased surface area also can allow a cooler surface through convection (Levine, 2011).

Improves Community Livability

Permeable pavement can improve livability within the community through reduction of local noise pollution. Recent studies have demonstrated that the use of permeable pavement can reduce roadway noise by as much as 10 dB (Olek et al., 2003; Gerharz 1999). Permeable pavement achieves noise reduction by increasing street porosity levels; the amount of reduction is related to the pavement porosity and traffic speed.

Maintenance

Maintenance needs to be performed on a regular basis to prevent clogging of permeable pavement. Clogging results from fine particles, which in turn trap larger particles, accumulating in the void space of permeable pavements. The particles can come from the wear of the pavement itself debris from passing cars. Clogging can be prevented through periodic sweeping and vacuuming. A high-pressure water jet cleaning often follows the sweeping or vacuuming. If the subsoil or subsoil filter cloth becomes clogged, complete replacement is required. It is recommended that a maintenance plan with scheduled inspections and cleaning be developed.

Implementation

Implementation challenges of permeable pavement are expected to be technical, as opposed to political in nature. A review of site conditions is necessary to determine the permeable pavement design options and preliminary features. Soil conditions and infiltration rates should be determined by a geotechnical evaluation as described in the above sections. The soil test should be completed at the elevation for which natural soil subgrade infiltration is being proposed. Permeable pavements can be used over low permeability soils, but alternative design features such as underdrains or a raised drain/outlet structure with greater reservoir storage would need to be included for proper system functionality (Eisenberg et al., 2013).

Contributing area run-on and land use will factor into the design of the permeable pavement system. Existing, proposed, and neighboring land use may create an increased risk for surface clogging and contamination. As stated in the North Carolina Department of Environment and Natural Resources (NCDENR) BMP Manual (NCDENR, 2012), "Permeable pavement should not be used to treat stormwater hotspot areas where concentration of pollutants such as oils and grease, heavy metals, and toxic chemicals are likely to be significantly higher than in typical stormwater runoff." Generally, permeable pavements are intended for capture of precipitation falling directly on the surface only, avoiding run-on carrying fine sediments that will clog pores and reduce overall infiltration capacity.

Subsurface Detention/Retention

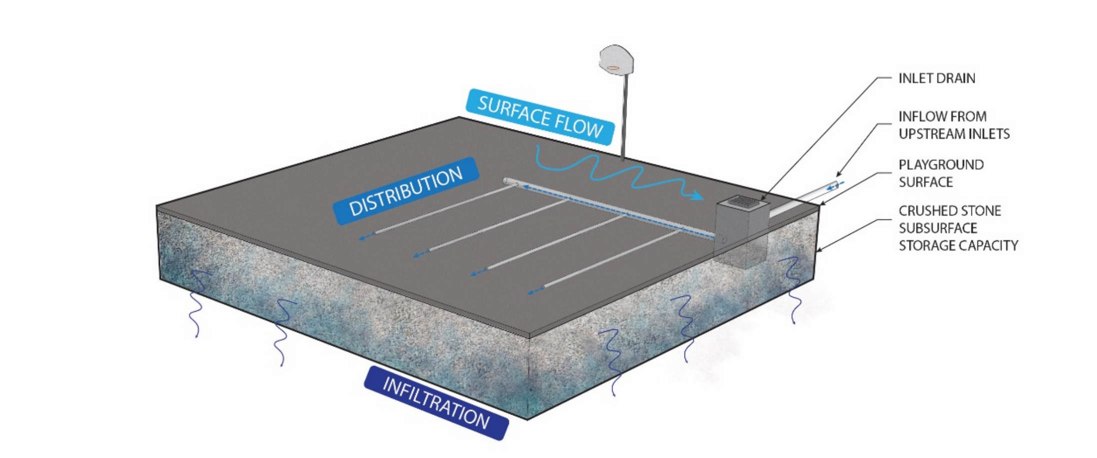

Figure 14 - Conceptual rendering of sub-surface storage

Engineering Performance and Cost Efficiency

A subsurface detention/retention system is proposed for the existing basketball courts in Washington Park. These systems receive stormwater from connected inlets and divert it into a gravel storage layer beneath programed surfaces. In the gravel layer, water either infiltrates or is detained in the gravel layer. Water detained in the gravel layer can be slowly released to the existing sewer system through an underdrain. The subsurface system would receive stormwater from inlets placed in adjacent areas and nearby roads to increase collection volume. The inlet points would require sediment sumps to prevent clogging of the subsurface gravel layer. A subsurface detention/retention system beneath the existing skate park in Washington Park may be a less politically challenging alternative to the proposed treatment wetland and could be constructed beneath a functioning skate park.

Retrofitting an impervious surface with a sub-surface detention structure finds the bulk of the costs with the excavation and disposal of in-situ soil, and the replacement of that soil with clean, washed broken stone. In the long term and with proper sediment removal and maintenance, these systems can work efficiently with little additional cost.

Scenario	Construction Cost	Annual Maintenance Cost	Dollar per Gallon of Annual Runoff Managed	Projected 5-Year Dollar per Gallon of Runoff Managed
Washington Park				
Skate Park Sub-Surface Retention Retrofit	$275,000 - $350,000	$260 - $600	$0.19 - $0.25	$0.04 - $0.05
Basketball Court Sub-Surface Retention Retrofit	$250,000 - $325,000	$380 - $775	$0.59 - $0.76	$0.12 - $0.15
Downtown				
Market Square Walkway Retrofit	$96,000 - $168,000	$1,000 - $1,250	$0.05 - $0.09	$0.01 - $0.02

Co-Benefits

Groundwater Recharge and Energy Reduction

Runoff directed toward the sub-surface storage facilities permits infiltration and enhances groundwater recharge.

Maintenance

The maintenance tasks of the subsurface detention/retention system are limited to the collection and distribution system. Inlet sumps that accumulate sediment and debris from the upland areas require periodic cleaning to ensure functionality and prevent clogging of the gravel storage layer. The underdrains and distribution pipes would have cleanouts to allow for cleaning on an as-needed basis. Failure to clean the underdrains and distribution pipes could lead to clogging.

Implementation

It is not expected that the subsurface detention/retention system would have many implementation challenges. The system would be constructed underground, allowing the existing landscape and functionality to be maintained. The basketball courts and skatepark can remain in their current capacity serving local residents. Infiltration rates could be testing during construction to determine the necessity and extent of the underdrain system.

Green Roofs

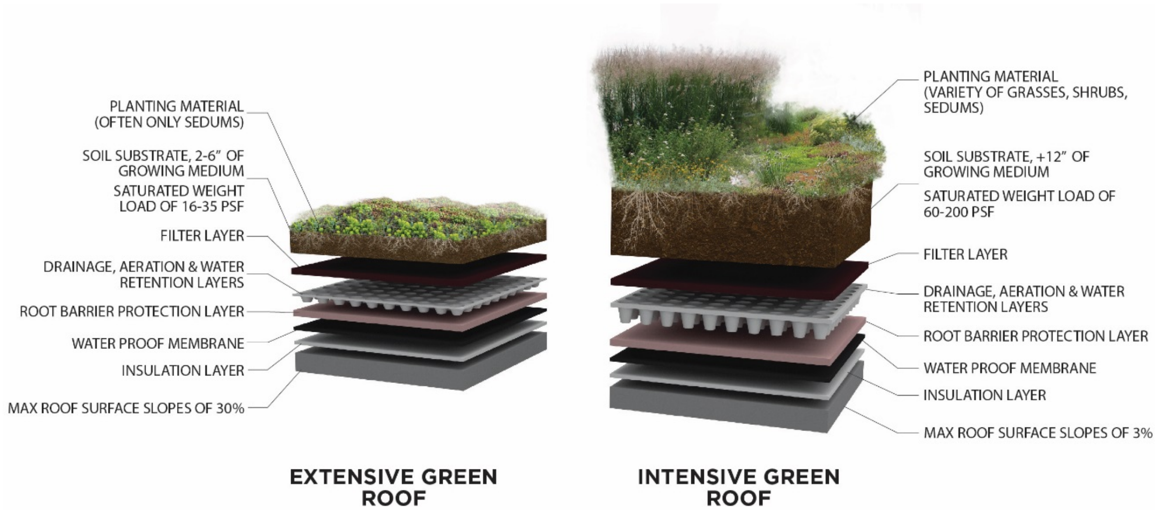

Figure 15 - Green Roof Components

Engineering Performance and Cost Efficiency

The initial location identified for a green roof, the Mental Health Facility, was eliminated during stakeholder conversations. Currently, no specific sites are proposed for green roof construction; however, due to their potential for stormwater management and various co-benefits, green roofs should be considered for other locations in Perth Amboy as they present themselves.

Green roofs can be categorized into three typologies: extensive, intensive, or semi-intensive. Extensive green roofs consist of a shallow planting medium and low vegetation planted uniformly over a roof. Primarily installed for environmental and visual benefits, extensive green roofs are lightweight and often require little maintenance. Intensive green roofs are designed for human use and typically incorporate a variety of plants, including shrubs and trees. These more complex roofing systems typically require landscape maintenance, water collection systems, enhanced roofing structure, and/or fertilization, and thereby are significantly more expensive than extensive rooftops. Semi-intensive green roofs are a mixture of extensive and intensive rooftops. They have a greater diversity of plants than extensive green roofs, incorporating plants such as perennials or small shrubs, but cannot support trees or large shrubs like intensive roofs due to its shallower growing medium depth. The cost of semi-intensive rooftops is in-between extensive and intensive green roofs.

Because green roofs typically manage only direct precipitation, their cost efficiency is derived more from energy savings related to reduced heating and cooling costs than from stormwater management. From the perspective of stormwater management they tend to be the least cost-efficient technology, particularly in situations where a structural retrofit is required for existing buildings.

Co-Benefits

Improved Roof Longevity

Traditional bituminous roof membranes are often degraded by solar exposure and ultraviolet radiation. By physically protecting against UV light with growing media and plant material and reducing temperature fluctuations, green roofs extend the lifespan of the roof's membrane. The temperature fluctuations for green roofs have been shown to be as little as 3°C where some standard roof diurnal fluctuations reach up to 50°C. The reduction in temperature fluctuation reduces the stress of daily expansion and contractions (Connelly and Liu, 2005). This temperature stabilization of the waterproofing membrane may extend its useful life by more than 20 years (EPA, 2000).

Urban Heat Island and Building Temperature Reduction

Green roofs reduce heat transferred through the roof by promoting evapotranspiration, physically shading the roof, and increasing insulation and thermal mass. Reducing the heat transferred lowers the energy demands of the building's cooling system (Del Barrio, 1998). Studies have shown green roofs reducing an eight-story residential building's cooling load by 6% and a 60% reduction for a typical residential size house (Saiz et al. 2006). Generally, the higher the roof-to-wall area, the greater the effect on energy consumption from green roof installation. Wong et al. (2003) showed installation of a green roof resulted in a 15% annual energy consumption savings.

The reduction in incident solar radiation gain from planting media, shade from plant material, and transpiration helps mitigate the Urban Heat Island Effect. Up to a 90% reduction in solar energy gain can be achieved by green roofs compared to non-shaded buildings (Getter and Rowe, 2006).

Habitat Creation and Community Livability

Green roofs provide vegetation and soil on a surface that would otherwise be bare and impervious. Green roofs are commonly inhabited by various insects and by nesting birds and native pollinators. These findings have mobilized conservation organizations to promote green roof habitat. Findings have also encouraged green roof design strategies to maximize biodiversity and promote habitat.

Green roofs also increase comfort for people living in urban areas. Reduction in building heat transfer improves indoor comfort and reduction in heat stress (EPA). If the green roof is accessible as a community space, it can achieve relaxation and restoration benefits as a visual relief. Intensive green roofs offer an opportunity for urban agriculture which provides both economic and educational benefits.

Green roofs absorb sound waves outside buildings and prevent inward transmission that reduces sound pollution (Dunnett and Kingsbury, 2004). Research shows that 12 cm of green roof substrate alone can diminish noise by 40 dB (Peck and Kuhn, 2001).

Improvement of Air Quality

Green roofs improve air quality through filtration of particulate matter and reduction of gaseous air pollutants. The vegetation on green roofs removes these pollutants through dry deposition and carbon sequestration and storage (EPA). Many studies have shown green roofs' potential to remove particulates, sulfur oxides, nitrous acid, and a variety of other air contaminants. Ground level ozone is formed more readily with an increase in temperature, thus green roofs slow the production of this ozone by lowering air temperatures.

Maintenance

The primary maintenance requirements for green roofs have to do with plant maintenance and debris removal to prevent clogging. Clogging of overflows or drainage outlets can sometimes be required after a large storm, but periodic inspection should be performed several times annually, especially during the first years after installation and until the specific behavior of the green roof system is better understood.

Plant maintenance requirements will depend on whether the green roof is intensive or extensive as well as the planting regime chosen. Extensive green roofs typically support only a small variety of plants, mostly sedums, which are well adapted to the wet/dry environment, and may require irrigation during summer dry spells, especially during the establishment period. Intensive systems generally retain more moisture and require less (or no) irrigation. Due to the larger variety of plant species, intensive green roofs may require greater attention to assure that the plant communities are able to remain healthy and to prevent a flush of undesirable weeds. Plant care on any green roof is most critical during establishment, which lasts 18 to 24 months (Tolderlund, 2010). The general plant maintenance tasks include weeding, watering, thinning, pruning, fertilizing and occasional plant replacement, instructions for which will be better described by the installer. Most plant maintenance can be performed by the roof owners or interested tenants. Maintenance contracts are often negotiated with the green roof installer for the first one to three years after installation.

Maintenance and visual inspection of the waterproofing membrane is necessary as leaks can occur at joints, penetrations, and flashings due to poor installation or material failure. Alternatively, electronic leak detection systems between or underneath the membranes can pinpoint exact locations of water leaks. In addition, any areas or joints where the roof is penetrated, such as vents, ducts, drains, and expansion joints should be regularly inspected and kept free of roots, leaves, and debris.

Implementation

The most important factor in siting a green roof is ensuring the building can support the additional weight added by the green roof. A structural assessment must be done by an engineer to verify that the roof and its support system are adequate. A structural assessment of each building within the project area was not plausible; thus other factors, such as roof slope, sizes, and landscape, were considered during the desktop assessment of potential green roof locations within the project area.

Green roofs siting must consider roof slope. Roof slopes under ten degrees are best suited for green roofs but, it is possible to install a green roof on a slope of up to 30 degrees. Size is also a factor in green roof siting, as a smaller roof area will be less cost efficient, since they require more detailed work when installing the membrane. Similarly, roofs with many protrusions, such as skylights, vents, or mechanical systems can become more costly. Naturally, cost structures change when green roofs are installed as part of a needed roof replacement, or when new buildings are constructed. Structurally enhancing existing roofs so that they can bear the additional load is generally not a cost-effective measure. In some instances, it may be possible to provide an intensive (deep) green roof that receives runoff directed from a higher roof area.

Rain Barrels

Figure 16 - Rain Barrel stormwater collection unit

Source: US EPA

Engineering Performance and Cost Efficiency

In many communities across the country, utilities and advocacy groups have distributed plastic rain barrels to property owners for collection rainwater from downspouts. Most barrels possess only a 55 gallon capacity, which represents only a fraction of the potential capture from a typical rooftop; one inch of rainfall reaching a 1,000 square foot roof will generate more than 600 gallons. As a viable mitigation strategy, rain barrels are minimally effective unless configured in banks of four or more; but as an educational strategy, this practice captures the attention of residents and introduces the concept of managing stormwater runoff within one's property. Additionally, since the stored volume will need to be released prior to any subsequent rain event, residents learn techniques for reusing runoff within gardens or for cleaning, further enhancing their understanding of rain water and its role in the landscape. In locations with larger lots and pervious soils, downspouts can simply be routed to a lawn where the water is infiltrated into the soil, which reduces maintenance requirements. This was not considered for Perth Amboy.

The performance model was run under three scenarios, with 50%, 10% and 2.5% of homes possessing operational rain barrels. The low implementation values were chosen to account for inefficient use of these systems, as residents sometimes neglect to assure that the barrels is drained in a timely manner.   One remedy used in helping residents drain rain barrels consistently is to attach a low-flow or soaker hose to the barrel's drain, directing the discharge toward garden or lawn areas.

While inexpensive to purchase, distribute, and install, the effectiveness of rain barrels can vary widely depending on the maintenance habits of the owner. This is demonstrated by comparing the cost efficiency between the second and third scenarios below. While maintenance is voluntary and of no-cost to the municipality, similar costs may arise in the form of ongoing outreach and training programs for the final owners of these installation. The nature of these programs can vary widely, however, and so the costs associated with ongoing outreach programs were not investigated.

Scenario	Number of Rain Barrels	Construction Cost	Annual Maintenance Cost	Dollar per Gallon of Annual Runoff Managed	Projected 5-Year Dollar per Gallon of Runoff Managed
Washington Park					
50% Implementation	150	$11,250 - $15,000	n/a	$0.02 - $0.03	< $0.01
25% Implementation	75	$5,625 - $7,500	n/a	$0.02 - $0.03	< $0.01
25% Implementation; 10% Functioning	75	$5,625 - $7,500	n/a	$0.18 – $0.24	$0.04 - $0.05
Downtown					
50% Implementation	55	$4,125 - $5,500	n/a	$0.02 - $0.03	< $0.01
25% Implementation	28	$2,100 - $2,800	n/a	$0.02 - $0.03	< $0.01
25% Implementation; 10% Functioning	28	$2,100 - $2,800	n/a	$0.23 – $0.31	$0.05 – $0.06

Co-Benefits

Groundwater Recharge

Runoff directed toward pervious surfaces that permit infiltration enhance groundwater recharge.

Potable Water Use Savings

Rainwater collected after a storm event can be used for some non-potable purposes, replacing the use of tap water for such things as washing clothes, cars, or outdoor spaces. The water can also be used during draughts to water lawn areas or maintain gardens.

Urban Agriculture

Harvested water can be used to maintain garden or aquatic systems in urban and suburban neighborhoods. Since rain barrels will be collecting water during a storm event, gardens and lawns will not need to be watered immediately. Larger planting areas, such as community gardens or urban farms, can benefit from use of a larger storage cistern that holds water for later irrigation use.

Community Engagement, Education, and Environmental Stewardship

Rain barrel programs have been an excellent vehicle for promoting environmental stewardship. Communities nationwide have implemented rain barrel programs in schools with students at a young age to engage them and begin to educate them on environmental issues. Teaching children about the use of green infrastructure is introduces larger issues such as water and air pollution and cultivates a sense of ownership and environmental awareness.

Maintenance

Mosquito Prevention

Rain barrels with sealable tops are generally good at keeping out mosquitoes, however, cracks and tiny openings in the spout or other connections can provide entry points. Correctly installing screens can also limit mosquito breeding. Screens should be changed no less than every two years. One can purchase mosquito dunks, which are made from organic material that prevents mosquito breeding. Another option is to add a couple of tablespoons of vegetable oil to the barrel. The oil film suffocates mosquito larvae. Especially in the summer, ensure that unprotected rain barrels are completely drained within a week of the end of a rain event to prevent any standing water from becoming a breeding environment.

Winter Maintenance

In order to prevent cracks due to winter freeze, rain barrels should be drained and disconnected from the downspout and garden hose during the winter. Any spigot or hose attachments should also be removed before winter storage. Rain barrels can be stored indoors or outdoors, as long as they are disconnected and not in a position to collect further precipitation, i.e. capped or upside down. Barrels should be cleaned and cleared of debris and sediment build-up, especially screens.

Overflow Concerns

Rain barrels and their maximum water storage capacity are constrained by their size. Unless several barrels are attached to each downspout, most storms will fill the rain barrel and cause it to overflow. Barrels and banks of barrels should be configured with an overflow mechanism that diverts excess runoff to a safe location. Preferably, the barrel overflow can be piped to vegetated areas such as a rain garden or lawn region where the water can infiltrate. If that option is not feasible, a rain barrel diverter will redirect flow back into the roof downspout and towards wherever the original spout was located. Overflow discharges should be released to stone beds or splash pads to prevent erosion.

Implementation

Cost

Most costs are upfront, and rain barrels require relatively minimal maintenance aside from routine discharge of barrel contents. If purchasing a pre-fabricated system, standard barrels made of plastic are the least costly. As designs become more elaborate and decorative, with various materials incorporated, the price will increase. According to Low Impact Development (LID) Urban Design Tools website and the US EPA Office of Water (https://www.lid-stormwater.net/raincist_cost.htm) a single rain barrel system, without downspout attachment or other accessories, costs on average $120. With additional parts, including diverter, overflow hose and additional guttering, an entire functioning system costs on average $216.

Many municipalities offer tax breaks and incentives for GI measures on private property. These range from reimbursing the cost of parts and installation, to annual tax reductions for those who correctly use their rain barrels to help minimize stormwater contributions into the municipal sewer system. In Portland, OR, property owners can arrange for free City work or do the work themselves and be reimbursed up to $53 per eligible downspout. Over 50,000 downspouts have already been disconnected there, removing more than 1.2 billion gallons of stormwater per year from the combined sewer system (https://www.portlandoregon.gov).

Accessible Resources

Many municipalities and local universities offer outreach programs and workshops which teach residents how to convert plastic garbage bins they may already own into functioning rain barrels. Perth Amboy has already begun such efforts with a Rain Barrel giveaway program. These outreach programs and community extension services also provide trouble shooting for those interested in establishing a rainwater harvesting system on their property, with specialists and technicians acting as liaisons between the local government and the community to instruct on proper installation techniques, maintenance practices, and tailored systems for each property's requirements or constraints.

Visual Issues

Some property owners express reluctance to install a rain barrel because they fear that it will not look pleasant, will smell, or will attract pests. Some municipalities have sponsored community outreach programs to describe basic maintenance features (as mentioned above) and to help minimize issues of pest breeding or unwanted biota growth in rain barrels. Some programs engage students by providing materials to decorate rain barrels on a home or school property. Though more costly, manufacturers have developed barrels which are made from more aesthetically pleasing materials, such as wood, or stone, or plastic barrels have been modified to have more interesting and architectural forms.

Downspout Planters

Figure 17 - Conceptual rendering of a downspout planter courtesy of the Philadelphia Water Department

Engineering Performance and Cost Efficiency

Downspout planters are similar to a rain barrels in that they receive roof runoff diverted away from municipal sewer system. A downspout planter functions like small scale bioswale, where captured rain is filtered by soil media and is absorbed by plant roots. In addition to reducing contributions to combined sewers, downspout planters also provide multiple environmental and social benefits to the communities.

For this analysis, different adoption rates (50% and 10%) of downspout planters by commercial properties were modeled.

Co-Benefits

Environmental Awareness and Stewardship

Downspout planters and rain barrels both provide an excellent social benefit in stimulating a sense of ownership in terms of small-scale GI, and fostering a sense of environmental stewardship. Some municipal programs, such as the Philadelphia Water Department's "Rain Check" program, include signage for public education purposes.

Unlike rain barrels, downspout planter's plants and flowers serve as a direct physical "green" element, and caring for these plants can allow for community members to feel a sense of pride and attachment to their GI practice.

Habitat Creation

Habitat benefits from downspout planters are similar to those for bioswales, though on a slightly smaller scale (see bioswale section above).

Community Greening

In addition to acting as a stormwater management feature, downspout planters act as beautification measures. The planter can be planted with native species which bloom in various seasons, and can include a wide range of species of water loving plants to ensure visually pleasing atmospheres throughout the growing season. Finally, most planter boxes are created from wood due to ease of construction and cost of materials; however, planter box design is limitless and can incorporate many other materials and designs to accent any landscape theme.

Reduction of Urban Heat Island

Although small in area, a single vegetated planter box does help in combating the Urban Heat Island Effect. However, as small scale GI becomes more popular and implemented on more properties, their combined efforts do amount to a significant contribution to combating UHI.

Maintenance

Plant Health

Watering is required during early establishment; once weekly for the first month after installation. Plants used in the planter box will need to be able to endure periods of inundation from a heavy rain events, as well as dryer periods between storms. Plants should be selected from a list of native species preapproved for use in green infrastructure practices (usually provided by local horticulture groups or water authorities). General plant health should be regularly checked; plants should be pruned, and dead material and weeds removed as needed.

Drainage Issues

During heavy storms, the rate at which water is diverted from the roof into the planter may exceed the rate which water drains through the planter box. In this case, an overflow weir or riser will allow excess water to drain back to the downspout connection to prevent the planter box from over-filling. Atrium inlet caps are preferable in this instance versus flat top caps for the overflow pipe, due to their rounded geometry which prevents leaves and larger debris from impeding the draining process. When no geotextile fabric installed between the soil and gravel layers, or when the geotextile comes loose from the sides of the planter, fine particles from the top layers of the planter may move to the gravel layer and clog the underdrain pipe. In order to prevent this, installing a cleanout pipe is recommended. This feature, which is comprised of a basic 90 degree pipe bend extending up past the top surface in the planter, allows owners access to the underdrain to remove any materials using a “snaking” method.

Planter Box Longevity

To avoid rot of a wooden planter box due to prolonged exposure to moist soil, secure a plastic impermeable liner on the interior of the planter. Applying a finish or outdoor strength paint will also extend the life of the planter box despite inclement weather. Using plastic lumber will secure longevity of the planter. Another important feature is to ensure the overflow outlet is secure and directing water back into the drain or other safe location, as the planter will be close to a building facade and could cause moisture problems if the overflow begins to drip or pond outside of the box.

Implementation

Property owners can be wary of the cost of installing a downspout planter. Conceptual models of downspout planters by the Philadelphia Water Department estimated a total cost of materials at upwards of $285 (Philadelphia Water Department, 2009). Besides the material fees, property owners may also be concerned with the work that needs to be done to modify their existing downspout. The design becomes more complicated if the property currently has no exterior downspout or one of poor quality. When compared with rain barrels, planters possess a slightly more complicated piping system such as the use of underdrains.

Many municipalities offer services to help property owners assess the feasibility of installing GI like downspout planters, including providing the physical resources to construct the system. The “Rain Check” program from Philadelphia’s Water Department provides online tools for property managers to educate them on various GI options and verify if they qualify for a downspout planter (Philadelphia Water Department, 2018). An inspector visits the property to site the planter, taking into consideration the spatial requirements and availability, location and condition of existing downspouts. Then, contractors return with materials and install the downspout planter for a small fee, and most projects will include planting materials free of charge.

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APPENDIX A – Soil Investigation Data

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 1 OF 7

PROJECT: Perth Amboy
STUDY AREA: Washington Park Area
LOCATION: Colgate Ave and New Brunswick Ave

INSPECTOR: N/A	DATE 7/18/17
CONTRACTOR: N/A	START: 8:40
DRILLER: AXR	END: 9:25
HELPER: NP	

Depth of Hole: 4' 8"	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
0' – 1'	-reddish brown loam sandy silt with trace gravel -dry, moderately compacted [ML]			R =	-friable
1' – 2'	-same as above until depth of 1'6" -light brown clayey silt with cobbles -moist, loose [ML]			R =	
2' – 3'	-brown, silt with gravel and traces of sand -moist, loose [ML]			0 R=	-friable
3' – 4'	-reddish brown sand silt and gravel -moist, loose [SW-SM]			0 R=	
4' – 5'	-same as above, refusal at depth of 4'8" [SW-SM]			0 R=	-refusal likely due to large cobbles

Inspector Remarks:

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 2 OF 7

PROJECT: Perth Amboy
STUDY AREA: Washington Park Area
LOCATION: Washington Park

INSPECTOR: N/A	DATE 7/18/17
CONTRACTOR: N/A	START: 10:55
DRILLER: AXR	END: 11:30
HELPER: NP	

Depth of Hole: 4' 6"	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
0' – 1'	-sandy silt loam -loose, dry -traces of gravel [SM-ML]			R =	
1' – 2'	-reddish brown sandy silt with clay -traces of gravel and cinders -dry, loose			R =	-most likely fill
2' – 3'	-more gravel and cobbles than 2' -darker brown color at depth of 2' 8" [ML]			0 R=	
3' – 4'	-light brown silt with traces of sand and gravel -moist, soft [ML]			0 R=	-most likely fill
4' – 5'	-same as above [ML]			0 R=	-water table at 4' 6"

Inspector Remarks:

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 3 OF 7

PROJECT: Perth Amboy
STUDY AREA: Washington Park Area
LOCATION: Corner of Neville St and Lee St.

INSPECTOR: N/A	DATE 7/18/17
CONTRACTOR: N/A	START: 11:45
DRILLER: AXR	END: 12:30
HELPER: NP	

Depth of Hole: 3'	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
0' – 1'	-sand with traces of silt -moist [SP-SM]			R =	
1' – 2'	-sand and gravel with traces of silt -moist [SP-SM]			R =	
2' – 3'	-silty clay with traces of sand -moist [CL]			0 R=	failure at 3'
3' – 4'				0 R=	
4' – 5'				0 R=	

Inspector Remarks:

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 4 OF 7

PROJECT: Perth Amboy
STUDY AREA: Washington Park Area
LOCATION: Corner of Neville St and Lee St.

	DATE 7/18/17
INSPECTOR: N/A	
CONTRACTOR: N/A	START: 1:20
DRILLER: AXR	END: 1:55
HELPER: NP	

Depth of Hole: 3'	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
0'					
0'–1'	-dark brown, silty sand with traces of gravel -slightly moist [SP-SM]			R =	
1'–2'	-dark brown, well graded sand with traces of silt -small bits of gravel -dry [SW-SM]			R =	
2'–3'	-reddish dark brown -moderately compacted -traces of gravel and cobbles -dry [ML]			0 R=	
3'–4'	-red brown -traces of cobble and gravel -dry and compact -traces of clay [ML]			0 R=	Failure at depth of 3' 9"
4'–5'				0 R=	

Inspector Remarks:

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 5 OF 7

PROJECT: Perth Amboy
STUDY AREA: Washington Park Area
LOCATION: Corner of Homman St and Brace St.

INSPECTOR: N/A	DATE 7/18/17
CONTRACTOR: N/A	START: 2:05
DRILLER: AXR	END: 2:50
HELPER: NP	

Depth of Hole: 3'	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
	3" topsoil				
0' – 1'	-red, silty sand with gravel -dry, loose [SM]			R =	
1' – 2'	-more clay and silt than above -blueish clay dry [ML]			R =	
2' – 3'	-red, dark brown gravel and cobbles with sandy silt -traces of clay -dry, moderately compact [ML]			0 R=	
3' – 4'	-dark brown, red mostly silt mix -dry, with dry clay lens			0 R=	
4' – 5'				0 R=	

Inspector Remarks:

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 6 OF 7

PROJECT: Perth Amboy
STUDY AREA: Washington Park Area
LOCATION: 621 Hanson Ave

INSPECTOR: N/A	DATE 7/18/17
CONTRACTOR: N/A	START: 4:00
DRILLER: AXR	END: 4:30
HELPER: NP	

Depth of Hole: 3'	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
	3" topsoil				
0' – 1'	-slightly red, graded sand -dry, loose -trace gravel [SW]			R =	
1' – 2'	-red sand -dry, loose -cobbles and gravel present [SW-SM]			R =	
2' – 3'	-reddish brown sandy silt -dry, moderately compact -trace gravel [ML]			0 R=	
3' – 4'	-same as above			0 R=	failure at 4'
4' – 5'				0 R=	

Inspector Remarks:

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 7 OF 7

PROJECT: Perth Amboy
STUDY AREA: Washington Park Area
LOCATION: Corner of Brale St and Colgate St.

INSPECTOR: N/A	DATE 7/28/17
CONTRACTOR: N/A	START: 8:25
DRILLER: AXR	END: 8:40
HELPER: NP	

Depth of Hole: 3'	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
	3" topsoil				
0' – 1'	-dark brown, sandy silt with traces of clay and gravel -moderately compacted [ML]			R =	
1' – 2'	-dark brown, reddish sandy silt with traces of gravel and clay -dry, compact -more cobbles present than above			R =	
2' – 3'				0 R=	failure at 2' 6"
3' – 4'				0 R=	
4' – 5'				0 R=	

Inspector Remarks:

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 1 OF 6

PROJECT: Perth Amboy
STUDY AREA: Downtown
LOCATION: McClellan St. Parking Lot

INSPECTOR: N/A	DATE 7/26/17
CONTRACTOR: N/A	START: 9:41
DRILLER: AXR	END: 10:20
HELPER: NP	

Depth of Hole: 5'	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
0'–1'	-reddish brown -silt, clay, with traces of sand -gravel -dry, loose [ML]			R =	
1'–2'	-grey brown -clay silt with traces of sand -gravel -loose -moist, wet clumps [ML-CL]			R =	
2'–3'	-grey clay with dark brown silt -gravel, traces of sand -moist, loose [LL]			0 R=	- traces of organic material
3'–4'	-reddish brown -clay silt with sand -traces of gravel -dry with pockets of moist, med compact material [ML]			0 R=	
4'–5'	-reddish brown sand -coarse to fine -traces of silt and gravel -med compact -dry [SW]			0 R=	

Inspector Remarks:

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 2 OF 6

PROJECT: Perth Amboy
STUDY AREA: Downtown
LOCATION: King St.

INSPECTOR: N/A	DATE 7/26/17
CONTRACTOR: N/A	START: 10:30
DRILLER: AXR	END: 10:55
HELPER: NP	

Depth of Hole: 5'	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
	8" topsoil				
0'	-grey clay with trace silt and sand -dry, moderately compact [CL]			R =	
1'	-clay with brown silt -trace sand -dry, moderately compact [CL]			R =	
2'	-dark brown silty clay -moist, loose -some sand and gravel [ML-LL]			0 R=	- glass fragments, urban fill
3'	-brown, clayey silt with trace sand -dry, moderately compact [ML]			0 R=	
4'	-brown, sandy, silt with clay -moist, moderately compact			0 R=	
5'					

Inspector Remarks:

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 3 OF 6

PROJECT: Perth Amboy
STUDY AREA: Downtown
LOCATION: High St.

INSPECTOR: N/A	DATE 7/26/17
CONTRACTOR: N/A	START: 11:05
DRILLER: AXR	END: 11:45
HELPER: NP	

Depth of Hole: 5'	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
	4" topsoil				
0' – 1'	-brown silty sand loose, dry [SM]			R =	
1' – 2'	-reddish brown silty sand -dry, moderately compact -traces of clay [SM]			R =	
2' – 3'	-same as above until depth of 2'5" -orange/yellow/brown -coarse - fine sand with traces of silt -moist, loose [SW]			0 R=	
3' – 4'	--same as above until depth of 3'3" -yellow brown clay-silt -grey clay -moderately compact -traces of sand -saturated [CL]			0 R=	-likely a perched groundwater table @ 3'8" -water found at 3'9"
4' – 5'	-grey clay -brown/yellow silt -dense, moist [CL]			0 R=	

Inspector Remarks:

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 4 OF 6

PROJECT: Perth Amboy
STUDY AREA: Downtown
LOCATION: Corner of Gordon St. and Brighton St.

INSPECTOR: N/A	DATE 7/26/17
CONTRACTOR: N/A	START: 12:10
DRILLER: AXR	END: 12:55
HELPER: NP	

Depth of Hole: 5'	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
	4" topsoil				
0'–1'	-dark brown -dark grey silt with clay and traces of sand -dry, loose [ML]			R =	
1'–2'	-dark grey clay, silty clay with traces of sand -dry, moderately compact [CL]			R =	traces of organic matter and wood fragments
2'–3'	-dark grey clay -traces of silt -wet, compact [CL]			0 R=	-organic material present
3'–4'	-same as above -slightly more dry, moist			0 R=	
4'–5'	-yellow brown clayey silt with grey clay -compact -moist			0 R=	-water level seen at depth of 4' 6" (most likely a perched water table)

Inspector Remarks:

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 5 OF 6

PROJECT: Perth Amboy
STUDY AREA: Downtown
LOCATION: 97 Gordon St.

INSPECTOR: N/A	DATE 7/26/17
CONTRACTOR: N/A	START: 2:00
DRILLER: AXR	END: 2:35
HELPER: NP	

Depth of Hole: 5'	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
	8" topsoil				
0' – 1'	- light brown sand -dry, loose [SP]			R =	
1' – 2'	-light brown sand with traces of silt -slightly moist, loose [SP]			R =	-medium to fine sand
2' – 3'	- same as above [SP]			0 R=	
3' – 4'	-fine, silty sand, white -moderately compact -dry [SM]			0 R=	
4' – 5'	- same as above [SM]			0 R=	-more rust/iron oxidation apparent

Inspector Remarks:

	LOCATION NO.
Prepared for: City of Perth Amboy	SHEET 6 OF 6

PROJECT: Perth Amboy
STUDY AREA: Downtown
LOCATION: Corner of High St. and Gordon St.

INSPECTOR: N/A	DATE 7/26/17
CONTRACTOR: N/A	START: 2:45
DRILLER: AXR	END: 3:30
HELPER: NP	

Depth of Hole: 3' 6"	Spoon Type: N/A	Weight of Hammer: for casing: N/A
Rig Type: N/A	Drill Bit Type: Hand Auger	Weight of Hammer: for spoon: N/A
Casing Diameter: 4"		Type of Hammer: N/A

BORING LOG

Depth in feet (Below Ground)	Field Identification of Soil and Rock	SPT Blows per 6"	Sample No. & Depth	Recovery Length and SPT N Value	Remarks
	6" topsoil				
0'	-reddish, dark brown -silty sand -dry, moderately compact [SM]			R =	
1'	-dark brown -same qualities as above			R =	pieces of brick and concrete present
2'	-lighter brown silty sand -dry, moderately compact [SM]			0 R=	
3'	-same as above -could not penetrate past 3'6"			0 R=	
4'				0 R=	
5'					

Inspector Remarks:

Z:\1PROJECTS\1EDD\Perth Amboy_2016.04\04_Reports\QAPP\Appendix E - Boring Log (Downtown Area).xlsx

RUTGERS
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Experiment Station

Soil Testing Laboratory
Rutgers, The State University
ASB II
57 US Highway 1 South
New Brunswick, NJ 08901-8554

Soil Test Report

Lab #: 2017-61731

eDesign Dynamics
Alex Renner
402 West 40th Street
New York, NY 10018

arenner@edesigndynamics.com
(646)688-3113
(646)688-3664(fax)

Sample ID: S-1

Date Received: 2017-07-27
Date Reported: 2017-08-02

Washington Park - Colgate and Brace Ave

Results and Interpretations

Sandy Clay Loam

Special Tests Results

Mechanical Analysis- Sand= 65% Silt=12% Clay= 23% Texture: Sandy Clay Loam

Comments:

Find Rutgers Cooperative Extension Fact Sheets at www.njaes.rutgers.edu/pubs

Soil Program 2016 NAPT Participating Laboratory

RUTGERS
New Jersey Agricultural
Experiment Station

Soil Testing Laboratory
Rutgers, The State University
ASB II
57 US Highway 1 South
New Brunswick, NJ 08901-8554

Soil Test Report

Lab #: 2017-61732

eDesign Dynamics
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Date Received: 2017-07-27
Date Reported: 2017-08-02

Sample ID: S-2

Washington Park - Washington Park

Results and Interpretations

Sandy Loam

Special Tests Results

Mechanical Analysis- Sand= 72% Silt=11% Clay= 17% Texture: Sandy Loam

Comments:

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Soil Program 2016 NAPT Participating Laboratory

RUTGERS
New Jersey Agricultural
Experiment Station

Soil Testing Laboratory
Rutgers, The State University
ASB II
57 US Highway 1 South
New Brunswick, NJ 08901-8554

Soil Test Report

Lab #: 2017-61733

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(646)688-3664(fax)
Sample ID: S-3

Date Received: 2017-07-27
Date Reported: 2017-08-02

Washington Park - Lee and Neville

Results and Interpretations

Sandy Clay Loam

Special Tests Results

Mechanical Analysis- Sand= 54% Silt=18% Clay= 29% Texture: Sandy Clay Loam

Comments:

Find Rutgers Cooperative Extension Fact Sheets at www.njaes.rutgers.edu/pubs

Soil Program 2016 NAPT Participating Laboratory

RUTGERS
New Jersey Agricultural
Experiment Station

Soil Testing Laboratory
Rutgers, The State University
ASB II
57 US Highway 1 South
New Brunswick, NJ 08901-8554

Soil Test Report
Lab #: 2017-61734

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Date Received: 2017-07-27
Date Reported: 2017-08-02

Sample ID: S-4

Washington Park - Brace and Homman

Results and Interpretations

Sandy Clay Loam

Special Tests Results

Mechanical Analysis- Sand= 65% Silt=13% Clay= 22% Texture: Sandy Clay Loam

Comments:

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Rutgers
New Jersey Agricultural Experiment Station

Soil Testing Laboratory
Rutgers, The State University
ASB II
57 US Highway 1 South
New Brunswick, NJ 08901-8554

Soil Test Report

Lab #: 2017-61735

eDesign Dynamics
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(646)688-3664(fax)

Date Received: 2017-07-27
Date Reported: 2017-08-02

Sample ID: S-5

Washington Park - Hanson Ave

Results and Interpretations

Sandy Loam

Special Tests Results

Mechanical Analysis- Sand= 58% Silt=23% Clay= 19% Texture: Sandy Loam

Comments:

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Experiment Station

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Rutgers, The State University
ASB II
57 US Highway 1 South
New Brunswick, NJ 08901-8554

Soil Test Report

Lab #: 2017-61736

eDesign Dynamics
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Date Received: 2017-07-27
Date Reported: 2017-08-02

Washington Park - Colgate and Brace

Sample ID: S-6

Results and Interpretations

Sandy Clay Loam

Special Tests Results

Mechanical Analysis- Sand= 54% Silt=19% Clay= 28% Texture: Sandy Clay Loam

Comments:

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ASB II
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New Brunswick, NJ 08901-8554

Soil Test Report

Lab #: 2017-61737

eDesign Dynamics
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Sample ID: S-7

Date Received: 2017-07-27
Date Reported: 2017-08-02

Results and Interpretations

Downtown - McClelland St Lot

Sandy Loam

Special Tests Results

Mechanical Analysis- Sand= 78% Silt=13% Clay= 9% Texture: Sandy Loam

Comments:

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Soil Test Report

Lab #: 2017-61738

eDesign Dynamics
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Date Received: 2017-07-27
Date Reported: 2017-08-02

Sample ID: S-8

Results and Interpretations

Downtown - King St

Sandy Clay Loam

Special Tests Results

Mechanical Analysis- Sand= 61% Silt=14% Clay= 25% Texture: Sandy Clay Loam

Comments:

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Soil Test Report

Lab #: 2017-61739

eDesign Dynamics
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Date Received: 2017-07-27
Date Reported: 2017-08-02

Sample ID: S-9

Results and Interpretations

Sandy Loam

Downtown - Market Square

Special Tests Results

Mechanical Analysis- Sand= 72% Silt=10% Clay= 18% Texture: Sandy Loam

Comments:

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57 US Highway 1 South
New Brunswick, NJ 08901-8554

Soil Test Report

Lab #: 2017-61740

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Date Received: 2017-07-27
Date Reported: 2017-08-02

Sample ID: S-10

Results and Interpretations

Sandy Clay Loam

Downtown - Gordon and Brighton St

Special Tests Results

Mechanical Analysis- Sand= 58% Silt=16% Clay= 26% Texture: Sandy Clay Loam

Comments:

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Experiment Station

Soil Testing Laboratory
Rutgers, The State University
ASB II
57 US Highway 1 South
New Brunswick, NJ 08901-8554

Soil Test Report

Lab #: 2017-61741

eDesign Dynamics
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Sample ID: S-11

Date Received: 2017-07-27
Date Reported: 2017-08-02

Results and Interpretations

Sandy Loam

Downtown - 105 Gordon St

Special Tests Results

Mechanical Analysis- Sand= 78% Silt=10% Clay= 12% Texture: Sandy Loam

Comments:

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New Brunswick, NJ 08901-8554

Soil Test Report
Lab #: 2017-61742

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(646)688-3664(fax)
Sample ID: S-12

Date Received: 2017-07-27
Date Reported: 2017-08-02

Results and Interpretations

Downtown - Gordon and High St

Sandy Loam

Special Tests Results

Mechanical Analysis- Sand= 70% Silt=14% Clay= 16% Texture: Sandy Loam

Comments:

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Soil Program 2016
NAPT
Participating Laboratory

LOCATION NO.	Site B-1	PT at 5 ft
Sheet	1 of	1

Prepared for:

PROJECT: Perth Amboy GI Study
LOCATION / BOROUGH : Washington Park Study Area
Hanson Ave

INSPECTOR: A Renner
CONTRACTOR eDesign Dynamics
DRILLER:
HELPER:
Start Date and Time: 8/8/2017 8:30am
Weather: 70 deg F - Partly Cloudy

Depth of PT tests: 5 feet
Rig Type:
Drill Bit Type: Hand Auger
Casing Inside Diameter: 4 in
Casing Length: 72 in
Weight of Hammer: for casing: n/a
Type of Hammer: n/a

PERMEABILITY COEFFICIENT (Kv) FORMULA:

Unit Independent Formula:

$$K_V = \pi \times \frac{\left[D\left\{Ln\left(\frac{h_1}{h_2}\right)\right\}\right]}{11 \times (t_2 - t_1)}$$

Formula for in/hr, for 4" I.D. casing:

$$K_V = 1.142 \times \frac{\left[Ln\left(\frac{h_1}{h_2}\right)\right]}{(t_2 - t_1)}$$

Formula for cm/sec, for 4" I.D. casing:

$$K_V = 2.9 \times \frac{\left[Ln\left(\frac{h_1}{h_2}\right)\right]}{(t_2 - t_1)}$$

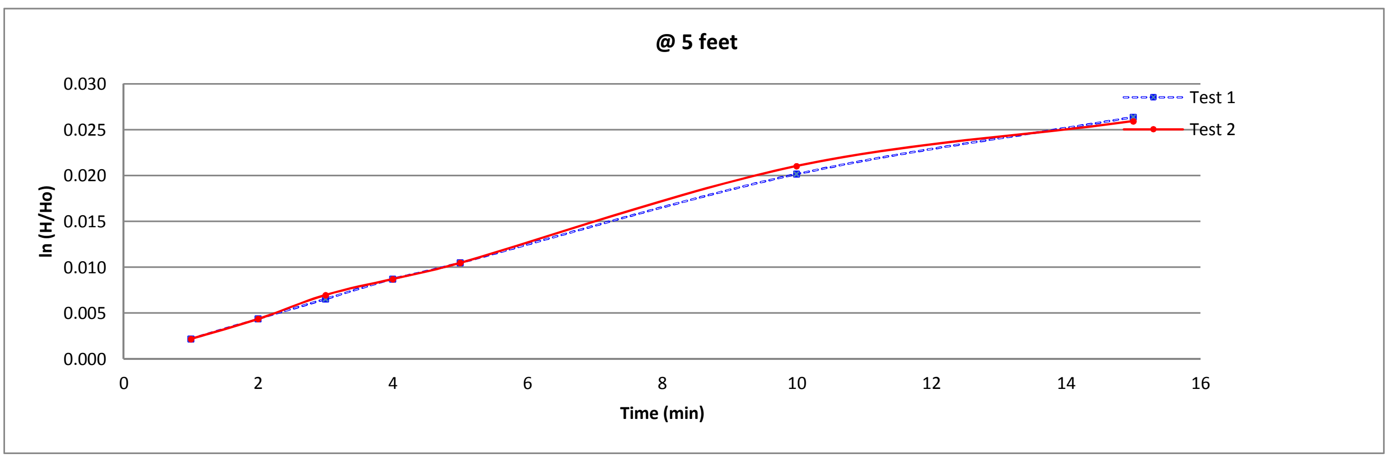
PERMEABILITY TEST @ 5 FEET

TEST 1

FIELD DATA		CALCULATED DATA			
Time (min)	Depth (in)	Height (in)	Ln (H/Ho)	(t_1-t_2)	*Kv (in/hr)
1	0.156	71.844	0.002	0.017	0.1489
2	0.313	71.688	0.004	0.017	0.1492
3	0.469	71.531	0.007	0.017	0.1496
4	0.625	71.375	0.009	0.017	0.1499
5	0.750	71.250	0.010	0.017	0.1201
10	1.438	70.563	0.020	0.083	0.1329
15	1.875	70.125	0.026	0.083	0.0853

TEST 2

FIELD DATA		CALCULATED DATA			
Time (min)	Depth (in)	Height (in)	Ln (H/Ho)	(t_1-t_2)	*Kv (in/hr)
1	0.156	71.844	0.002	0.017	0.1489
2	0.313	71.688	0.004	0.017	0.1492
3	0.500	71.500	0.007	0.017	0.1795
4	0.625	71.375	0.009	0.017	0.1199
5	0.750	71.250	0.010	0.017	0.1201
10	1.500	70.500	0.021	0.083	0.1451
15	1.844	70.156	0.026	0.083	0.0670



TEST 1 FINAL RESULTS

Time Weighted Average Permeability Coefficient	**Kv=**	0.1206 in/hr
	Kv=	8.507E-05 cm/sec

TEST 2 FINAL RESULTS

Time Weighted Average Permeability Coefficient	**Kv=**	0.1185 in/hr
	Kv=	8.364E-05 cm/sec

Inspector Remarks:
Casing Stick-Up = 12"
30 min Pre-soak = 9:15am
5 min Pre-soak = 10:01am

DEFINITION OF VARIABLES
*Kv= Vertical permeability
I.D. = Internal diameter of casing in the same units selected for Kv
Ln = Natural Logarithmic
t1 = Time at the start of the test in the same units selected for Kv
t2= Time at the end of the test in the units selected for Kv
h1= Height of the water above the bottom of the casing at the start of the test in the same units selected for Kv
h2= Height of the water above the bottom of the casing at the end of the test in the same units selected for Kv

	LOCATION NO. Site B-1 PT at 5 ft	Sheet 1 of 1

Prepared for:	PROJECT: Perth Amboy GI Study LOCATION / BOROUGH : Washington Park Study Area Colgate and Brace Ave
INSPECTOR: A Renner CONTRACTOR eDesign Dynamics DRILLER: HELPER:	Start Date and Time: 8/8/2017 10:20am Weather: 75 deg F - Partly Cloudy

Depth of PT tests: 5 feet	Drill Bit Type: Hand Auger	Weight of Hammer: for casing: n/a
Rig Type:	Casing Inside Diameter: 4 in	Type of Hammer: n/a
PERMEABILITY COEFFICIENT (Kv) FORMULA:	Casing Length: 72 in	

Unit Independent Formula:

$$K_V = \pi \times \frac{\left[D\left\{Ln\left(\frac{h_1}{h_2}\right)\right\}\right]}{11 \times (t_2 - t_1)}$$

Formula for in/hr, for 4" I.D. casing:

$$K_V = 1.142 \times \frac{\left[Ln\left(\frac{h_1}{h_2}\right)\right]}{(t_2 - t_1)}$$

Formula for cm/sec, for 4" I.D. casing:

$$K_V = 2.9 \times \frac{\left[Ln\left(\frac{h_1}{h_2}\right)\right]}{(t_2 - t_1)}$$

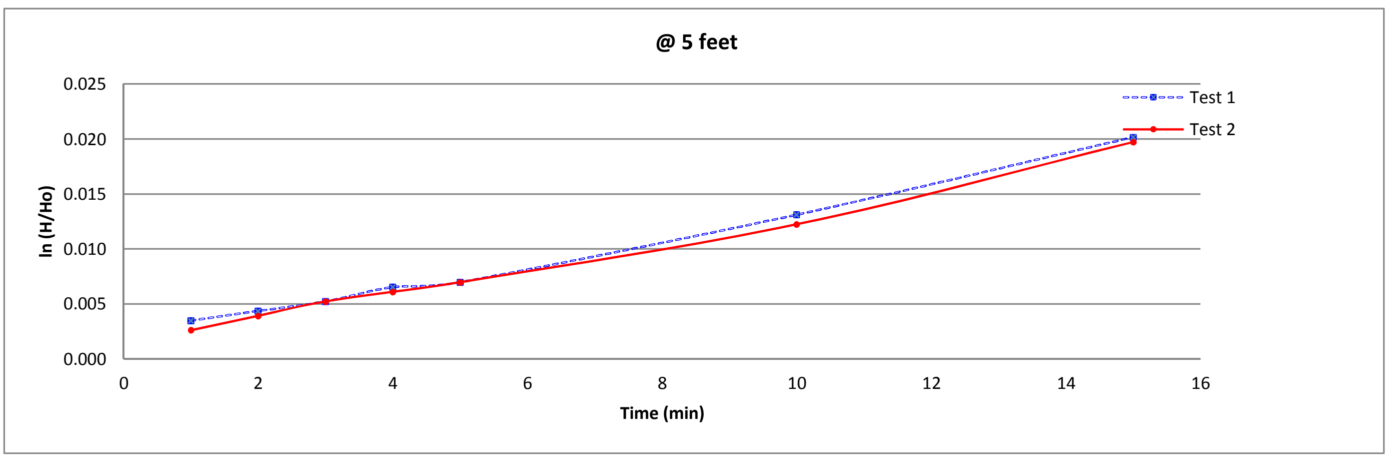
PERMEABILITY TEST @ 5 FEET

TEST 1

FIELD DATA		CALCULATED DATA			
Time (min)	Depth (in)	Height (in)	Ln (H/Ho)	$(t_1\text{-}t_2)$	*Kv (in/hr)
1	0.250	71.750	0.003	0.017	0.2384
2	0.313	71.688	0.004	0.017	0.0597
3	0.375	71.625	0.005	0.017	0.0598
4	0.469	71.531	0.007	0.017	0.0898
5	0.500	71.500	0.007	0.017	0.0300
10	0.938	71.063	0.013	0.083	0.0841
15	1.438	70.563	0.020	0.083	0.0968

TEST 2

FIELD DATA		CALCULATED DATA			
Time (min)	Depth (in)	Height (in)	Ln (H/Ho)	$(t_1\text{-}t_2)$	*Kv (in/hr)
1	0.188	71.813	0.003	0.017	0.1787
2	0.281	71.719	0.004	0.017	0.0895
3	0.375	71.625	0.005	0.017	0.0897
4	0.438	71.563	0.006	0.017	0.0598
5	0.500	71.500	0.007	0.017	0.0599
10	0.875	71.125	0.012	0.083	0.0721
15	1.406	70.594	0.020	0.083	0.1028



TEST 1 FINAL RESULTS

Time Weighted Average	**Kv=** 0.0922 in/hr
Permeability Coefficient	**Kv=** 6.502E-05 cm/sec

TEST 2 FINAL RESULTS

Time Weighted Average	**Kv=** 0.0901 in/hr
Permeability Coefficient	**Kv=** 6.359E-05 cm/sec

Inspector Remarks:

Casing Stick-Up = 12"

30 min Pre-soak = 11:34am

5 min Pre-soak = 12:20pm

DEFINITION OF VARIABLES

*Kv= Vertical permeability

I.D. = Internal diameter of casing in the same units selected for Kv

Ln = Natural Logarithmic

t1 = Time at the start of the test in the same units selected for Kv

t2= Time at the end of the test in the units selected for Kv

h1= Height of the water above the bottom of the casing at the start of the test in the same units selected for Kv

h2= Height of the water above the bottom of the casing at the end of the test in the same units selected for Kv

	LOCATION NO. Site B-1 PT at 5 ft Sheet 1 of 1

Prepared for:	PROJECT: Perth Amboy GI Study LOCATION / BOROUGH : Downtown Study area King St.

INSPECTOR: A Renner DRILLER: CONTRACTOR eDesign Dynamics HELPER:	Start Date and Time: 8/8/2017 1:05pm	Weather: 77 deg F - Sunny

Depth of PT tests: 5 feet Rig Type: **PERMEABILITY COEFFICIENT (Kv) FORMULA:**	Drill Bit Type: Hand Auger Casing Inside Diameter: 4 in Casing Length: 72 in	Weight of Hammer: for casing: n/a Type of Hammer: n/a

Unit Independent Formula:

$$K_V = \pi \times \frac{\left[D\left\{Ln\left(\frac{h_1}{h_2}\right)\right\}\right]}{11 \times (t_2 - t_1)}$$

Formula for in/hr, for 4" I.D. casing:

$$K_V = 1.142 \times \frac{\left[Ln\left(\frac{h_1}{h_2}\right)\right]}{(t_2 - t_1)}$$

Formula for cm/sec, for 4" I.D. casing:

$$K_V = 2.9 \times \frac{\left[Ln\left(\frac{h_1}{h_2}\right)\right]}{(t_2 - t_1)}$$

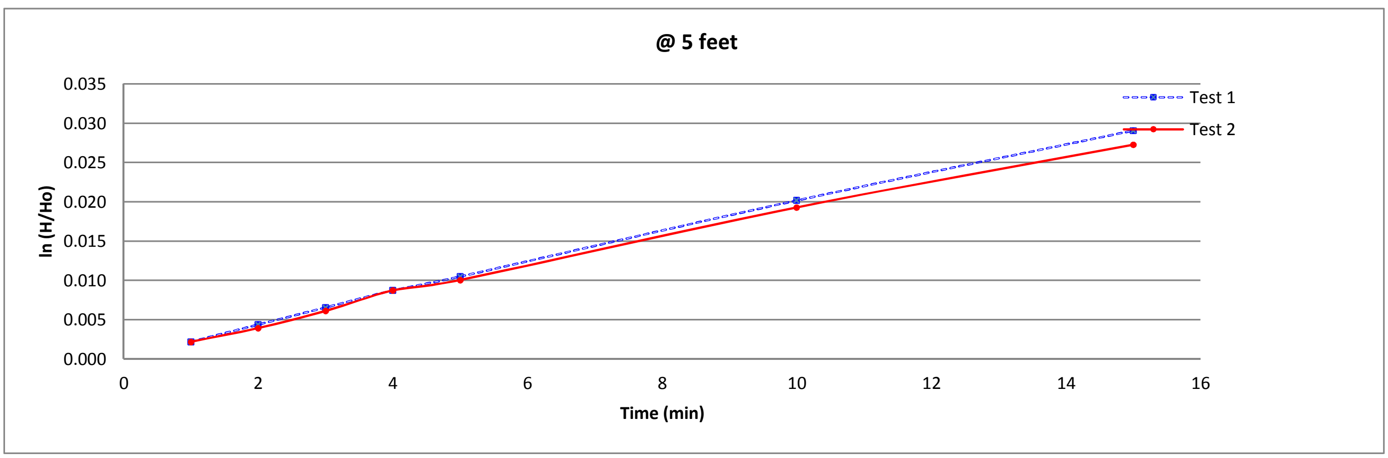
PERMEABILITY TEST @ 5 FEET

TEST 1

FIELD DATA		CALCULATED DATA			
Time (min)	Depth (in)	Height (in)	Ln (H/Ho)	(t_1-t_2)	*Kv (in/hr)
1	0.156	71.844	0.002	0.017	0.1489
2	0.313	71.688	0.004	0.017	0.1492
3	0.469	71.531	0.007	0.017	0.1496
4	0.625	71.375	0.009	0.017	0.1499
5	0.750	71.250	0.010	0.017	0.1201
10	1.438	70.563	0.020	0.083	0.1329
15	2.063	69.938	0.029	0.083	0.1220

TEST 2

FIELD DATA		CALCULATED DATA			
Time (min)	Depth (in)	Height (in)	Ln (H/Ho)	(t_1-t_2)	*Kv (in/hr)
1	0.156	71.844	0.002	0.017	0.1489
2	0.281	71.719	0.004	0.017	0.1194
3	0.438	71.563	0.006	0.017	0.1495
4	0.625	71.375	0.009	0.017	0.1798
5	0.719	71.281	0.010	0.017	0.0901
10	1.375	70.625	0.019	0.083	0.1268
15	1.938	70.063	0.027	0.083	0.1096



TEST 1 FINAL RESULTS

Time Weighted Average Permeability Coefficient	**Kv=**	0.1328 in/hr
	Kv=	9.371E-05 cm/sec

TEST 2 FINAL RESULTS

Time Weighted Average Permeability Coefficient	**Kv=**	0.1247 in/hr
	Kv=	8.795E-05 cm/sec

Inspector Remarks:

Casing Stick-Up = 12"

30 min Pre-soak = 1:45pm

5 min Pre-soak = 2:30pm

DEFINITION OF VARIABLES

*Kv= Vertical permeability

I.D. = Internal diameter of casing in the same units selected for Kv

Ln = Natural Logarithmic

t1 = Time at the start of the test in the same units selected for Kv

t2= Time at the end of the test in the units selected for Kv

h1= Height of the water above the bottom of the casing at the start of the test in the same units selected for Kv

h2= Height of the water above the bottom of the casing at the end of the test in the same units selected for Kv

	LOCATION NO. Site B-1 PT at 5 ft Sheet 1 of 1

Prepared for:	PROJECT: Perth Amboy GI Study LOCATION / BOROUGH : Downtown Study Area Gordon and High St.
INSPECTOR: A Renner DRILLER: CONTRACTOR eDesign Dynamics HELPER:	Start Date and Time: 8/8/2017 3:20pm Weather: 77 deg F - Sunny

Depth of PT tests: 5 feet	Drill Bit Type: Hand Auger	Weight of Hammer: for casing: n/a
Rig Type:	Casing Inside Diameter: 4 in	Type of Hammer: n/a
PERMEABILITY COEFFICIENT (Kv) FORMULA:	Casing Length: 72 in	

Unit Independent Formula:

$$K_V = \pi \times \frac{\left[D\left\{Ln\left(\frac{h_1}{h_2}\right)\right\}\right]}{11 \times (t_2 - t_1)}$$

Formula for in/hr, for 4" I.D. casing:

$$K_V = 1.142 \times \frac{\left[Ln\left(\frac{h_1}{h_2}\right)\right]}{(t_2 - t_1)}$$

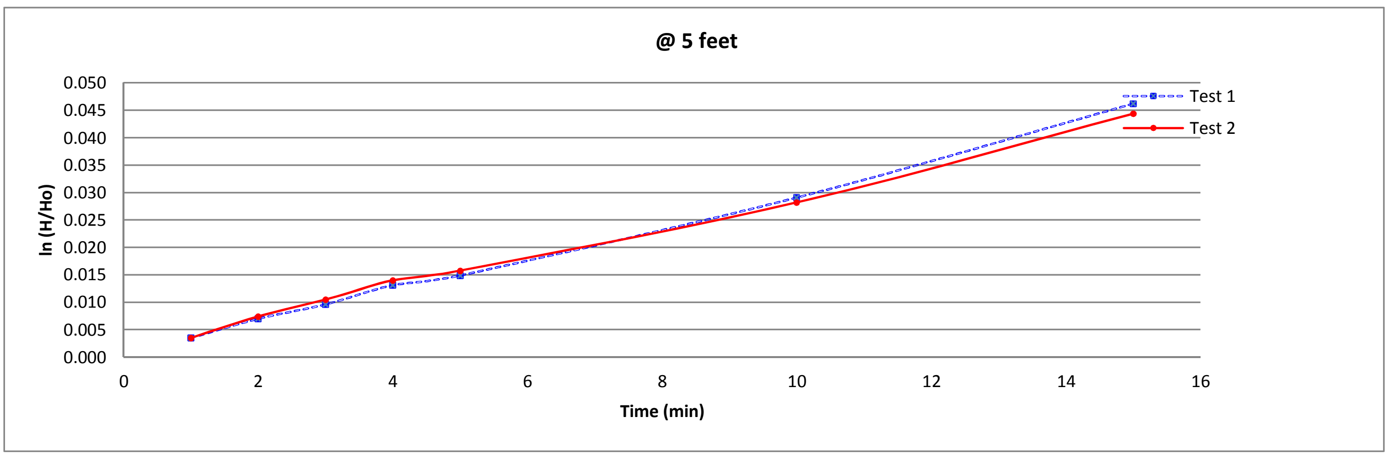
Formula for cm/sec, for 4" I.D. casing:

$$K_V = 2.9 \times \frac{\left[Ln\left(\frac{h_1}{h_2}\right)\right]}{(t_2 - t_1)}$$

PERMEABILITY TEST @ 5 FEET

TEST 1					
FIELD DATA		CALCULATED DATA			
Time (min)	Depth (in)	Height (in)	Ln (H/Ho)	(t_1-t_2)	*Kv (in/hr)
1	0.250	71.750	0.003	0.017	0.2384
2	0.500	71.500	0.007	0.017	0.2392
3	0.688	71.313	0.010	0.017	0.1800
4	0.938	71.063	0.013	0.017	0.2407
5	1.063	70.938	0.015	0.017	0.1207
10	2.063	69.938	0.029	0.083	0.1946
15	3.250	68.750	0.046	0.083	0.2348

TEST 2					
FIELD DATA		CALCULATED DATA			
Time (min)	Depth (in)	Height (in)	Ln (H/Ho)	(t_1-t_2)	*Kv (in/hr)
1	0.250	71.750	0.003	0.017	0.2384
2	0.531	71.469	0.007	0.017	0.2692
3	0.750	71.250	0.010	0.017	0.2101
4	1.000	71.000	0.014	0.017	0.2409
5	1.125	70.875	0.016	0.017	0.1208
10	2.000	70.000	0.028	0.083	0.1703
15	3.125	68.875	0.044	0.083	0.2221



TEST 1 FINAL RESULTS		
Time Weighted Average	**Kv=**	0.2111 in/hr
Permeability Coefficient	**Kv=**	1.489E-04 cm/sec

TEST 2 FINAL RESULTS		
Time Weighted Average	**Kv=**	0.2028 in/hr
Permeability Coefficient	**Kv=**	1.431E-04 cm/sec

Inspector Remarks:

Casing Stick-Up = 12"

30 min Pre-soak = 4:00pm

5 min Pre-soak = 4:50pm

DEFINITION OF VARIABLES

*Kv= Vertical permeability

I.D. = Internal diameter of casing in the same units selected for Kv

Ln = Natural Logarithmic

t1 = Time at the start of the test in the same units selected for Kv

t2= Time at the end of the test in the units selected for Kv

h1= Height of the water above the bottom of the casing at the start of the test in the same units selected for Kv

h2= Height of the water above the bottom of the casing at the end of the test in the same units selected for Kv

APPENDIX B – GI Options Matrices

Estimated Annual Stormwater Management Assessment - Washington Park

Note: All numbers reported on the following table are preliminary and subject to change.

GI Technology	Footprint	# of units	Total Footprint	Contributing Area (sf)	Contributing area % of total sewershed	New Brunswick Ave Flood Abatement*	Estimated yearly stormwater managed (gal.)	Estimated yearly stormwater retained (gal.)	% reduction in total sewer flow	% reduction in wet weather sewer flow	% Average reduction in peak flow rate	Installation Cost (low)	Installation Cost (high)	Dollars per gallon of annual stormwater managed (low)	Dollars per gallon of annual stormwater managed (high)	Estimated yearly maintenance cost (low)	Estimated yearly maintenance cost (high)	Projected 5-year dollars per gallon stormwater managed (low)	Projected 5-year dollars per gallon stormwater managed (high)
Skate Park sub-surface detention	8,580	1	8,580	117,100	5.0%	11%	1.4 million	600,000	1.81%	3.94%	3.00%	$275,000	$350,000	$0.19	$0.25	$260	$600	$0.04	$0.05
Skate Park Replacement - Detention Pond	12,000	1	12,000	117,100	5.0%	13%	1.6 million	780,000	2.36%	4.38%	3.00%	$200,000	$300,000	$0.13	$0.19	$1,250	$2,500	$0.03	$0.04
Senior Center Green Roof - Extensive	14,500	1	14,500	14,500	0.6%	< 0.1%	170,000	110,500	0.33%	0.47%	0.35%	$174,000	$261,000	$1.02	$1.54	$2,000	$3,900	$0.22	$0.49
Senior Center Green Roof - Intensive	14,500	1	14,500	14,500	0.6%	< 0.1%	188,000	150,400	0.45%	0.52%	0.38%	$362,500	$435,000	$1.93	$2.31	$2,000	$3,900	$0.40	$0.59
Senior Center Rain Garden	2,380	1	2,380	144,550	6.2%	14.0%	1.8 million	166,000	0.50%	4.88%	3.70%	$350,000	$450,000	$0.20	$0.26	$1,000	$2,000	$0.04	$0.05
Basketball Court GI	12,600	1	12,600	35,437	1.5%	< 0.1%	426,000	426,000	1.29%	1.29%	1.50%	$250,000	$325,000	$0.59	$0.76	$380	$775	$0.12	$0.15
Rain Barrels - 50% Implementation	n/a	150	n/a	191,000	8.1%	< 0.1%	576,000	711,000	1.74%	2.15%	1.62%	$11,250	$15,000	$0.02	$0.03	n/a	n/a	< $0.01	< $0.01
Rain Barrels - 25% Implementation	n/a	75	n/a	96,000	4.1%	< 0.1%	288,000	288,000	0.87%	1.07%	0.82%	$5,625	$7,500	$0.02	$0.03	n/a	n/a	< $0.01	< $0.01
Rain Barrels - 25% Implementation, 1/10 functioning	n/a	8	n/a	96,000	4.1%	< 0.1%	30,720	38,000	0.09%	0.11%	0.08%	$5,625	$7,500	$0.18	$0.24	n/a	n/a	$0.04	$0.05
ROW Bioswales - Full Implementation	100 SF each	60	6,000	420,000	17.9%	40%	5.0 million	419,000	1.27%	13.86%	10.50%	$1,200,000	$1,500,000	$0.24	$0.30	$17,400	$34,800	$0.05	$0.07
ROW Bioswales - Priority Implementaiton (50% of inlets with largest catchments)	100 SF each	30	3,000	270,000	11.5%	26%	3.3 million	209,000	0.63%	9.15%	6.90%	$600,000	$750,000	$0.18	$0.23	$8,700	$17,400	$0.04	$0.05
ROW Bioswales - High Priority Implementaiton (25% of inlets with largest catchments)	100 SF each	15	1,500	162,000	6.9%	13%	2.0 million	105,000	0.32%	5.54%	4.10%	$300,000	$375,000	$0.15	$0.19	$4,350	$8,700	$0.04	$0.04
												low	high	low	high				
							Max. sewer flow reduction and cost of implementation	1,941,400	7.61%	27.07%	20.70%	$2,362,500	$3,010,000	0.26	0.34				

*Flood abatement is expressed as a percent reduction in the total estimated flood volume. The flood volume is estimated to be approximately 17,000 CF for a 1.25" storm.

Estimated Annual Stormwater Management Assessment - Downtown

Note: All numbers reported on the following table are preliminary and subject to change.

GI Technology	Footprint (sf)	# of units	Total Footprint (sf)	Contributing Area (sf)	Contributing area % of total sewershed	Estimated annual stormwater managed (gal.)	Estimated annual stormwater retained (gal.)	% reduction in total sewer flow	% reduction in wet weather sewer flow	% Average reduction in peak flow rate	Installation Cost (low)	Installation Cost (high)	Dollar per gallon of annual stormwater managed (low)	Dollar per gallon of annual stormwater managed (high)	Estimated annual maintenance cost (low)	Estimated annual maintenance cost (high)	Projected 5-year dollar per gallon stormwater managed (low)	Projected 5-year dollar per gallon stormwater managed (high)
Hobart St Municipal Lot Permeable Pavement	10,300	1	10,300	10,300	0.5%	180,000	180,000	0.4%	0.4%	0.5%	$41,200	$72,100	$0.23	$0.40	$950	$1,250	$0.01	$0.09
Hobart St Municipal Lot Permeable Pavement with adjacent roof contribution	10,300	1	10,300	16,500	0.9%	376,000	376,000	0.8%	0.8%	0.9%	$51,500	$82,400	$0.14	$0.22	$1,040	$13,050	$0.03	$0.05
Rain Barrels - 50% Residential Implementation	n/a	55	n/a	191,000	10.1%	231,000	231,000	0.5%	0.50%	0.40%	$4,125	$5,500	$0.02	$0.02	n/a	n/a	< $0.01	< $0.01
Rain Barrels - 25% Residential Implementation	n/a	28	n/a	96,000	5.1%	84,000	84,000	0.2%	0.20%	0.20%	$2,100	$2,800	$0.03	$0.03	n/a	n/a	< $0.01	< $0.01
Rain Barrels - 25% Residnetial Implementation, 1/10 functioning	n/a	3	n/a	96,000	5.1%	9,000	9,000	0.0%	0.0%	0.0%	$2,100	$2,800	$0.23	$0.31	n/a	n/a	$0.05	$0.06
ROW Bioswales - Full Implementation	100 each	39	3,900	492,000	25.9%	9.3 million	725,000	1.6%	19.1%	17.0%	$780,000	$975,000	$0.08	$0.10	$11,310	$22,620	$0.02	$0.02
ROW Bioswales - Priority Implementaiton (50% of inlets with largest catchments)	100 each	20	2,000	300,000	15.8%	5.7 million	372,000	0.8%	11.7%	10.4%	$400,000	$500,000	$0.07	$0.09	$5,800	$11,600	$0.02	$0.02
ROW Bioswales - High Priority Implementaiton (25% of inlets with largest catchments)	100 each	10	1,000	175,000	9.2%	3.3 million	186,000	0.4%	6.8%	6.0%	$200,000	$250,000	$0.06	$0.08	$2,900	$5,800	$0.01	$0.02
Market Square Paver Storage	4,800	1	4,800	96,000	5.1%	1.8 million	890,000	2.0%	3.7%	1.9%	$96,000	$168,000	$0.05	$0.09	$1,040	$1,250	$0.01	$0.02
											low	high	low	high	low	high		
						Max. sewer flow reduction and cost of implementation	2,222,000	5.0%	24.1%	20.2%	$931,625	$1,230,900	$0.08	$0.11	$13,390	$36,920		

APPENDIX C - Assessment of Habitat Conditions

Prior to selecting sights for intervention, EDD performed an area assessment of habitat resources, deficiencies and gaps within Perth Amboy, its shoreline and the adjacent estuary. Locations were identified within the landscape where habitat value and connectivity could be enhanced, bridging gaps between resources at both inland and shoreline locations. While the boundary between freshwater and saltwater habitats appears vivid, there exists a complex set of conditions at these interfaces, with specialized ecosystems and plant communities adapted to highly variable salinity and erosive coastal forces. These systems have been historically degraded through human activities, and are hindered in their recovery by two principal factors: poor water quality and loss of adjacent supporting habitat.

Stakeholder's interest was in identifying locations where interventions can be leveraged to promote additional benefits within the Estuary and also complement missing ecosystem services and degraded natural resources. The assessment involved review of available literature and data sources, planning documents (such as the LTCP) and the City's SWMM model. Current and historical aerial imagery was utilized to assess relatively recent changes in the landscape and shoreline, and records of past land use practices were reviewed that influenced the loss of natural systems. Locations of limited public access were identified as well as popular public amenities, and opportunities to introduce new natural amenities that could both attract the public and provide new footholds for the establishment of shoreline and marine ecosystems were considered. Finally, the threat of sea level rise and the need for enhanced coastal protections from storm surge was assessed, and the role that natural systems, such as oyster reefs, salt marsh and planted dunes provide in protecting upland resources were evaluated.

APPENDIX D – Newark Airport 2008 Hourly Precipitation Timeseries

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080101 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080101 09:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080101 10:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080101 11:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080101 12:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080102 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080102 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080102 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080105 20:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080105 21:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080105 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080105 23:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080106 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080106 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080106 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080109 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080109 09:00	0
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080110 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080110 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080110 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 01:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 02:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 03:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 04:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 05:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 06:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 07:00	0.12
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 08:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 13:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080111 14:00	0.13
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080113 23:00	0.05
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080114 02:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080114 03:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080114 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080114 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080114 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080114 07:00	0
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080114 20:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080114 21:00	0.02
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080117 20:00	0.02
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Station ID	Station Description	Date and Time	Precipitation depth (in.)
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080118 01:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080118 02:00	0.14
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080118 03:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080118 04:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080118 05:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080118 06:00	0.05
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080201 15:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080201 16:00	0.04
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080205 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080206 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080206 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080206 09:00	0.04

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080206 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080206 15:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080206 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080207 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080207 02:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080207 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080207 04:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080207 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080207 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080209 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080209 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080209 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080209 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080209 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080209 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080209 23:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080210 00:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080210 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080210 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080210 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080210 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080210 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080210 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080212 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080212 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080212 14:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080212 15:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080212 16:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080212 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080212 18:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080212 19:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080212 20:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080212 21:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080212 22:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080212 23:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 00:00	0.11
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 01:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 02:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 03:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 05:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 06:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 07:00	0.23
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 08:00	0.22
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 09:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 10:00	0.13
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 11:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 12:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 13:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 14:00	0.26
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 15:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 16:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 17:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 18:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080213 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080214 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080217 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080217 20:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080217 21:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080217 22:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080217 23:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080218 00:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080218 05:00	0.08

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080218 06:00	0.12
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080218 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080218 15:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080218 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080218 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080218 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080218 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 02:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 03:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 04:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 05:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 06:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 07:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 08:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 09:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 10:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 11:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 12:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 13:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 14:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 15:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 19:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 20:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080222 23:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080223 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080223 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080223 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080223 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080223 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080223 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080223 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080223 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080223 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080226 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080226 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080226 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080226 16:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080226 17:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080226 18:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080226 19:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080226 20:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080229 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080229 22:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080229 23:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080301 00:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080301 01:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080301 02:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080301 03:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080301 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080301 07:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080301 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080301 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080301 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080304 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080304 14:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080304 15:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080304 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080304 17:00	0

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080304 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080304 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080304 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080305 03:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080305 04:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080305 05:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080305 06:00	0.14
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080305 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080305 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080305 10:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080305 11:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080307 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080307 17:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080307 18:00	0.13
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080307 19:00	0.2
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080307 20:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080307 21:00	0.17
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080307 22:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080307 23:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 00:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 03:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 04:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 11:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 12:00	0.2
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 13:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 14:00	0.11
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 15:00	0.34
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 16:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 17:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 18:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 19:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080308 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080312 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080312 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080314 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080314 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080314 22:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080314 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080315 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080315 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080315 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080315 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080315 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080315 05:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080315 06:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080316 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080316 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080316 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080316 06:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080316 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080316 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080316 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080316 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080316 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080316 14:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080318 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 03:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 04:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 05:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 06:00	0.07

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 07:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 08:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 09:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 10:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 11:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 12:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 14:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 15:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 16:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 17:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 18:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 19:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 20:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080319 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080320 00:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080320 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080320 02:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080320 03:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080320 04:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080320 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080327 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080327 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080327 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080327 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080327 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080327 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080327 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080327 23:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080328 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080328 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080328 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080328 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080328 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080328 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080331 10:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080331 11:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080331 12:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080331 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080331 14:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080331 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080331 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080331 20:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080331 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080331 22:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080331 23:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 03:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 04:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 10:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 11:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080401 22:00	0.19
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080403 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080403 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080403 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080404 00:00	0.03

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080404 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080404 02:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080404 03:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080404 04:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080404 05:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080404 06:00	0.13
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080404 07:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080404 08:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080404 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080404 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080405 03:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080405 04:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080405 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080409 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080409 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080409 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080409 23:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080411 22:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080411 23:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080412 00:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080412 01:00	0.66
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080412 02:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080412 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080412 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080413 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080420 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080425 23:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080426 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080426 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080426 02:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080426 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080426 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080426 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080427 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080427 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080427 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080427 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080427 06:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080427 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080427 08:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080427 09:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080427 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 03:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 05:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 06:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 07:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 08:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 09:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 10:00	0.14
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 12:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 13:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 14:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 15:00	0.11
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 16:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 17:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 18:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 19:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 20:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 21:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080428 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080429 00:00	0

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080429 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080429 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080429 04:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080429 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080429 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080429 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080429 11:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080429 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080429 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080501 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080501 19:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080501 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080501 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080502 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080502 01:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080502 02:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080503 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080503 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080503 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080503 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080504 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080504 01:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080504 02:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080504 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080504 04:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080504 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080506 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080506 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080508 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080508 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080508 07:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080508 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080508 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080508 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080508 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080508 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 04:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 05:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 06:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 07:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 08:00	0.01
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 10:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 11:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 12:00	0.12
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 13:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 14:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 15:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 16:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 17:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 18:00	0.19
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 19:00	0.11
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 20:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 21:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 22:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080509 23:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080510 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080512 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080512 05:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080512 06:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080512 07:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080512 08:00	0

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080512 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080512 10:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080512 11:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080512 12:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080512 13:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080512 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 08:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 09:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 10:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 11:00	0.12
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 12:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 13:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 14:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 15:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 16:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 17:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 19:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 20:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 21:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 22:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080516 23:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080517 00:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080517 01:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080517 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080517 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080517 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080517 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080517 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080518 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080518 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080518 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080518 14:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080518 15:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080518 16:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080518 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080518 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080518 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080519 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080519 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080519 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080520 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080520 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080520 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080520 12:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080520 13:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080520 14:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080520 15:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080520 16:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080520 17:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080520 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080521 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080521 14:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080521 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080521 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080521 18:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080521 19:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080522 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080522 07:00	0.01

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080522 08:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080522 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080522 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080522 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080522 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080522 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080526 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080527 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080527 05:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080527 06:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080527 07:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080527 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080527 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080527 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080527 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080531 12:00	0.59
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080531 13:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080531 20:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080601 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 00:00	0.12
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 01:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 02:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 03:00	0.33
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 04:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 05:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 06:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 20:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080604 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080605 00:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080605 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080605 02:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080605 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080606 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080607 21:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080607 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080608 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080608 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080608 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080610 21:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080610 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080614 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080614 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080614 19:00	1.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080614 20:00	0.23
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080614 21:00	0.75
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080614 22:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080614 23:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080615 00:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080615 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080615 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080615 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080615 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080615 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080615 15:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080615 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080616 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080616 19:00	0

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080616 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080616 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080618 16:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080618 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080618 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080618 19:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080620 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080620 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080622 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080622 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080622 17:00	0.62
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080623 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080623 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080624 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080624 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080624 04:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080624 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080624 14:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080624 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080626 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080626 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080626 11:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080626 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080627 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080628 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080628 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080628 17:00	0.14
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080628 18:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080629 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080629 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080629 14:00	0.32
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080629 15:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080629 16:00	0.77
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080629 17:00	0.19
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080629 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080630 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080630 03:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080630 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080701 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080704 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080704 08:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080704 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080704 17:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080704 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080704 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080704 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080704 21:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080704 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080704 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080705 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080705 03:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080705 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080705 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080705 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080705 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080705 11:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080705 12:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080705 13:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080705 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080705 17:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080705 18:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080707 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080709 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080709 19:00	0

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080709 20:00	0.12
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080714 04:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080714 05:00	0.38
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080714 06:00	0.17
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080714 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080714 08:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080714 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080714 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080714 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080720 22:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080720 23:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080721 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080721 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080722 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080722 08:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080723 03:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080723 04:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080723 05:00	0.13
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080723 06:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080723 07:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080723 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080723 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080723 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080723 21:00	0.6
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080723 22:00	0.38
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080723 23:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080724 00:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080724 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080724 02:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080724 03:00	0.13
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080724 04:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080724 05:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080724 06:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080724 07:00	0.12
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080724 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080724 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080724 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080727 05:00	0.18
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080727 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080727 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080727 15:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080727 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080730 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080730 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080801 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080802 11:00	0.42
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080802 12:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080802 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080803 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080803 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080803 19:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080803 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080805 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080806 00:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080806 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080806 02:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080806 05:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080806 06:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080806 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080807 22:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080808 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080808 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080808 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080810 15:00	0.01

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080810 16:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080810 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080810 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080810 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080811 10:00	0.35
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080811 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080811 13:00	0.25
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080814 17:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080814 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080814 19:00	0.11
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080814 20:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080814 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080815 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080815 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080815 18:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080815 19:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080815 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080829 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080829 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080829 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080830 01:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080830 02:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080830 03:00	0.2
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080830 04:00	0.45
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080830 05:00	0.46
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080830 06:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080830 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080830 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080901 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080906 00:00	0.11
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080906 01:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080906 02:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080906 14:00	0.12
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080906 15:00	0.4
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080906 16:00	0.35
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080906 17:00	0.93
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080906 18:00	0.59
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080906 19:00	0.73
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080906 20:00	0.38
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080906 21:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080906 22:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080909 10:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080909 11:00	0.5
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080909 12:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080909 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080909 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080912 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080912 14:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080912 15:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080912 16:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080912 17:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080912 18:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080912 19:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080912 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080912 21:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080912 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080912 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080913 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080913 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080914 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080925 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080925 21:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080925 22:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080925 23:00	0.04

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 00:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 01:00	0.14
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 02:00	0.17
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 03:00	0.18
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 04:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 05:00	0.37
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 06:00	0.38
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 07:00	0.19
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 08:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 09:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 13:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 14:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080926 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080927 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080927 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080927 15:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080927 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080928 02:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080928 09:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080928 10:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080928 11:00	0.14
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080928 12:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080928 13:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080928 14:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080928 19:00	0.12
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080928 20:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080928 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080928 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080928 23:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080929 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080929 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20080929 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081001 00:00	0.07
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081001 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081001 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081001 17:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081001 18:00	0.13
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081001 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081001 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081001 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081004 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081004 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081005 04:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081005 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081005 06:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081005 07:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081006 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081008 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081009 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081009 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081009 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081009 04:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081009 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081009 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081016 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081016 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081021 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081021 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081025 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081025 13:00	0
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Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081025 15:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081025 16:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081025 17:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081025 18:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081025 19:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081025 20:00	0.21
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081025 21:00	0.24
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081025 22:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081025 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081027 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 00:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 01:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 02:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 03:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 04:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 05:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 06:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 08:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 09:00	0.59
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 10:00	0.21
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 11:00	0.31
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 12:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 15:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 17:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 18:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081028 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081029 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081029 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081029 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081029 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081029 12:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081029 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081029 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081029 15:00	0
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081103 04:00	0
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081103 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081104 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081105 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081105 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081105 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081105 17:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081105 18:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081105 19:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081105 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081105 21:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081105 22:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081105 23:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 00:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 02:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 08:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 11:00	0.04

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 12:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081106 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081107 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081107 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081108 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081108 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081108 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081108 13:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081108 14:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081108 15:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081108 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081109 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081109 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081109 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 03:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 12:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 13:00	0.17
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 14:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 15:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 16:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 19:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 20:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 21:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 22:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081113 23:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081114 00:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081114 01:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081114 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081114 03:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081114 04:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081114 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081114 15:00	0
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081114 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081114 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 04:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 05:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 06:00	0.16
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 07:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 10:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 11:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 19:00	0.26
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 20:00	0.11
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081115 23:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081116 00:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081116 01:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081116 02:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081116 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081118 08:00	0

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081118 09:00	0
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081118 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081118 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081120 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081124 22:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081124 23:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 00:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 01:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 02:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 03:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 04:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 06:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 09:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 10:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 11:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081125 13:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 08:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 09:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 10:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 11:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 12:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 13:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 14:00	0.1
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 15:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 16:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 17:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 18:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 19:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 20:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081130 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081201 00:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081201 01:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081201 02:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081201 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081201 04:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081201 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081201 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081204 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081204 18:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081204 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081204 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081204 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081204 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081204 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081205 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081206 21:00	0
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081207 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081207 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081207 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081207 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081209 19:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081209 21:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081209 23:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 00:00	0.01

Station ID	Station Description	Date and Time	Precipitation depth (in.)
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 11:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 12:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 15:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 16:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 17:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 18:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 19:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081210 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 04:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 05:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 06:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 07:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 08:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 09:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 10:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 11:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 12:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 13:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 14:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 15:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 16:00	0.05
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 17:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 18:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 19:00	0.14
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 20:00	0.36
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 21:00	0.28
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 22:00	0.28
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081211 23:00	0.17
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081212 00:00	0.2
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081212 01:00	0.24
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081212 02:00	0.22
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081212 03:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081212 04:00	0.14
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081212 05:00	0.28
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081212 06:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081212 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081212 08:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081212 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081213 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081213 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081215 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081215 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081215 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081215 19:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081215 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081215 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 00:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 03:00	0

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 07:00	0.05
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 14:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 17:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 19:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 21:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 22:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081216 23:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081217 00:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081217 01:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081217 02:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081217 03:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081217 04:00	0.03
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081217 06:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081217 07:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081217 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081217 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081217 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081217 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081219 11:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081219 12:00	0.11
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COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081219 14:00	0.15
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081219 15:00	0.13
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081219 16:00	0.2
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081219 17:00	0.16
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081219 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081219 19:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081219 20:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081219 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 00:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 05:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 07:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 08:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081220 23:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 00:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 01:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 03:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 04:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 05:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 06:00	0.01

Station ID	Station Description	Date and Time	Precipitation depth (in.)
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 07:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 08:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 09:00	0.13
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 10:00	0.13
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 11:00	0.08
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 12:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081221 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 04:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 05:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 06:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 07:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 08:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 09:00	0.03
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 10:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 11:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 12:00	0.11
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 13:00	0.06
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 14:00	0.04
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 15:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 18:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 19:00	0.07
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 20:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 22:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081224 23:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081225 00:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081225 01:00	0.02
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081225 02:00	0.09
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081226 21:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081226 23:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081227 00:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081227 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081227 02:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081227 04:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081227 15:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081227 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081228 01:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081228 02:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081228 06:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081228 07:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081228 08:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081228 09:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081228 10:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081228 13:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081228 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081228 16:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081231 09:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081231 10:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081231 11:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081231 12:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081231 13:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081231 14:00	0
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081231 15:00	0.01
COOP:286026	NEWARK LIBERTY INTERNATIONAL AIRPORT NJ US	20081231 16:00	0

Total precipitation depth (in.) 48.48