Work Plan for STAC Implementation Project Funding

Barnegat Bay Partnership - Soil Health Improvement Program

Project Justification:

Soil Health has been identified as a priority action item through the BBP and the STAC recommendation (Strategic Plan and Summary Statement on Sustaining Healthy Soils 2009).

A common impairment to estuarine systems like the Barnegat Bay is the eutrophication created from nonpoint sources including excessive nutrients. To restore these euthrophic waters we need to reduce excess phosphorous and nitrogen together with reducing the stormwater runoff volume created from changing land uses. It is for these reasons, the control of non point pollution centers on implementing effective soil management practices that sustain and restore the essential functions of healthy soils throughout our watersheds.

The addition of organic material is a relatively simple and highly effective method to improve the long term health of soil. The amount and type of organic material needed to optimize soil health and thereby improve soil function, is site-specific and dependent on a number of factors and soil properties. Assessing the soil health before, during and after incorporation of specified amounts of organic material will lead to a more definitive and quantifiable recommendation and guidelines. In order to effectively improve soil health throughout the Barnegat Bay watershed, a pre-determined methodology and protocol is needed. Once determined, then specifications can be developed that will assist in soil restoration. A long term goal of this project is to help transfer restoration technology to local communities, to build natural resource stewardship capacity and help empower municipalities to implement local guidelines that sustain soil health, thus improving water quality in the Barnegat Bay watershed.

Looking at existing communities within the Barnegat Bay watershed nearly 88% of the soils maybe characterized as sands and loamy sands. These sandy soils have nearly 50% pore space with rapid infiltration rates ranging 6-20 inches per hour. Healthy soils have the ability to accept, hold and release water and nutrients to plants. They help regulate water flow to our streams and the bay. As such, the ultimate goal of this project is to develop simple, low cost and practical soil restoration techniques and procedures that are transferrable at the homeowner, one yard at a time, scale.

Project Relevance to BBP Priorities: Strategic Plan – (WQ8 & WQ10)

The BBP 2008-2011 Strategic Plan identifies Water Quality and Eutrophication, as well as Water Supply and Flow Issues, as priorities. Healthy soils have the ability to accept, hold and release water and nutrients to plants. They help regulate water flow to our streams and the bay. And, they play an important role in preventing the decline of water quality problems such as algae blooms or brown tides in the bay. Soil that has been disturbed by construction activities or compacted has lost most of its characteristics and natural function. Testing to determine the microbial community and density in the soils is critical to identifying what steps need to be taken to revive the soil.

Problem:

Looking at existing communities within the Barnegat Bay watershed nearly 88% of the soils maybe characterized as sands and loamy sands. These sandy soils have nearly 50% pore space with rapid infiltration rates ranging 6-20 inches per hour. In their native woodland condition these coastal plain soils have little to no runoff contributing very minimal nutrients to the bay. The water holding capacity of these forested soils can easily store and filter at least a two year storm event or 3.4 inches of rainfall in twenty-four hours. The total of these two year storms represent nearly 95% of the total rainfall volume that fall throughout the year. These forested soils have a mixture of small, medium and large pore sizes allowing for the movement of air and water through the soil. The large pores (macropores) are formed by animals and plant roots and are open to the atmosphere. In our forests about 20-40 percent of the rainfall is intercepted by vegetation. Rainfall evaporates from the pine needles, oak leaves and tall grasses without ever touching the forested soil.

Compaction creates soils that no longer sustain the lawns and gardens we attempt to grow in them. Due to this dense soil our lawns and athletic fields all have shallow root systems. These landscapes are unable to absorb and utilize water, regardless of how often they are irrigated. This of course places a huge burden on our water supplies. These soils are almost as dense as concrete. And, the stormwater basins that we build do not properly drain down, water lays stagnant creating mosquito habitat and related health

problems. Soil compaction significantly alters water balance and quality, reduces groundwater recharge and vegetation and aquatic life. Compaction increases storm flows, scouring our stream corridors, increasing sedimentation and delivering more nutrients to the bay.

Benefits:

Healthy functioning soil provides many functions within ecosystems including the maintenance of plant growth. Topsoil captures and stores nutrients and rain, which are then used by plants and other flora and fauna within the soil ecosystem. Land development disturbs the soil ecosystem to the extent that the support of plant growth within urban landscapes is not feasible without supplemental inputs of fertilizer and irrigation. Moreover, the expertise to use these inputs efficiently within urban landscapes is limited. Thus, improving soil function would reduce supplemental fertilizer and irrigation inputs in urban landscapes as well as impacts on water quality and supply.

Over the long term, practices that de-compost soil and sustain adequate soil organic matter content are perhaps the cheapest and one of the most effective water conservation practices for landscapes and farmland. Organizations such as the Barnegat Bay Program, NJ DEP and others support efforts to maintain and improve infiltration for the purposes of reducing runoff and nutrient loadings and to sustain groundwater supplies. Presently, the New Jersey Legislature has introduced
S1410 Requiring the adoption of standards concerning **Soil** restoration measures. (Identical Bill A2501)

Team Members

STAC:	Michael DeLuca, BBP STAC Chair, Rutgers University IMCS
	Louise Wootton, BBP STAC Co-Chair, Georgian Court University
BBP Support:	Jim Vasslides, Science Coordinator
	Martha Maxwell Doyle, Project Coordinator
Administrative Oversight:	Ocean County Soil Conservation District
	David Friedman, Director
	William Slack, Assistant Director
	Christine Raabe, Education Coordinator
Other Partners:	Vicki Pecchioli – Ocean County Planning
	Helen Henderson – American Littoral Society
	Rich Mohr – Rutgers Cooperative Extension
	Cara Muscio – Rutgers Cooperative Extension
	Steven Souza – Princeton Hydro
	Lisa Auermuller, JCNERRS
	Mike Mangum, Ocean County Parks and Recreation
Principal Investigators:	Dr. James Murphy, Rutgers Agricultural Extension
	Dr. Jennifer Krumins, Montclair University

1 or 2 Signature Soil Restoration Demonstration Site(s)

Criteria for selection:

- High Visibility and Educational Opportunities
- Strategically located
- Publicly Owned
- Fully supported by land owner
- Appropriate location in support of Item #2 (see below)

Based on the criteria above, OCSCD has initiated a meeting with Mike Mangum, Director of Ocean County Parks and Recreation to assess areas of Jakes Branch County Park – Double Trouble Road, Beachwood to serve as demonstration sites. (See enclosed photos & map)

Key Proposal Components:

1. **Soil Research Plots & Demonstration (Site #1 on Map)**

   Two Main Components:

   Dr. James Murphy, Rutgers University, Principal Investigator

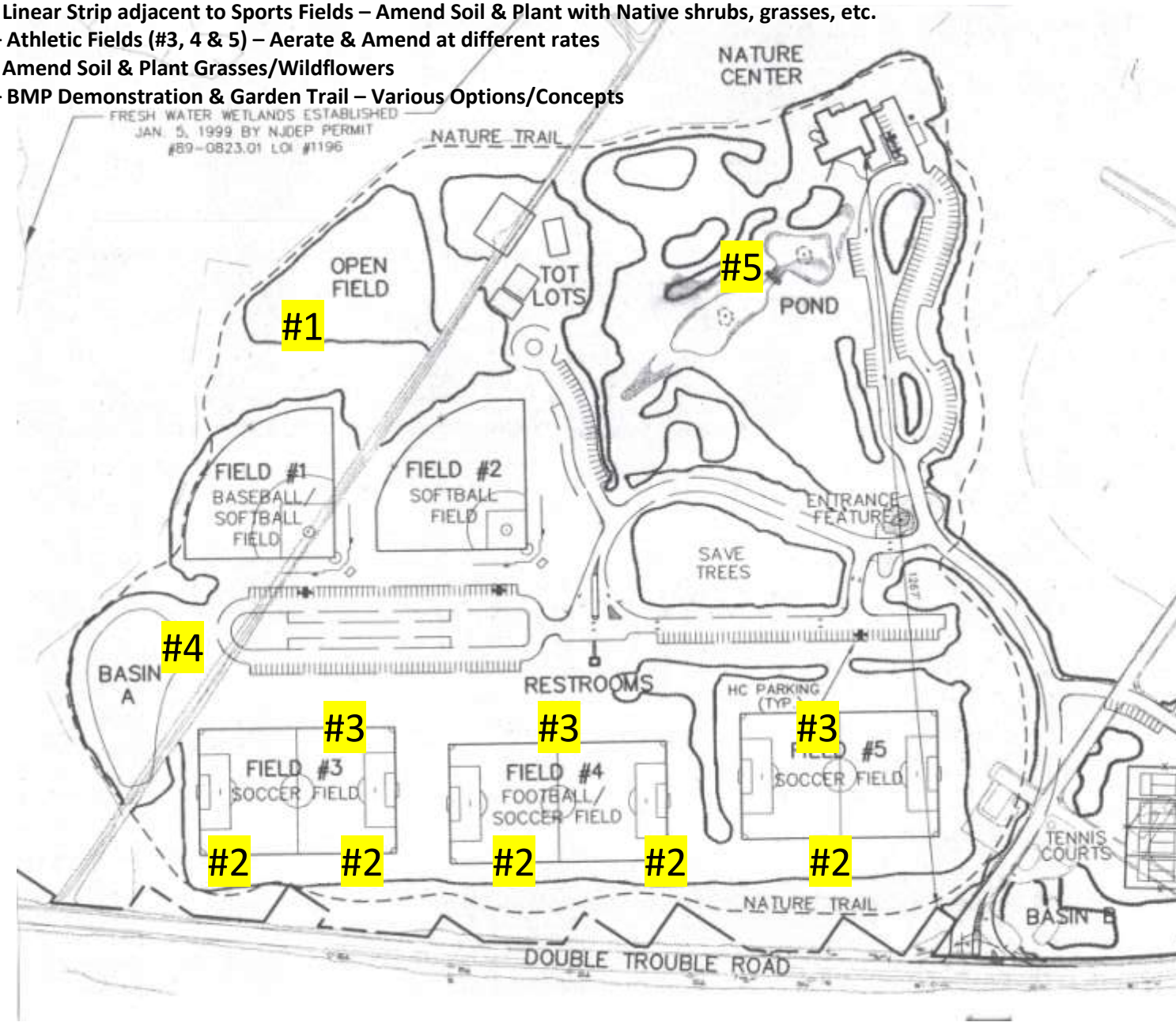
   "*Improvement of Soil Function through De- Compaction and Organic Matter Addition to Turf Managed Landscapes in the Barnegat Bay Watershed*"

   Dr. Jennifer Adams Krumins, Montclair University, Principal Investigator

   "Soil Micro Food Web Analysis - Microbial Community Evaluation"

2. **Soil Amendment and Native Plantings – Demonstration and Site Improvement (Sites #2,3,4 & 5 on Map)**
   PROPOSED SITE MAP OF SOIL DEMONSTRATIONS, RESTORATION AND RESEARCH LOCATIONS AT JAKES BRANCH PARK – (See Appendix 1 for photos of #1-5 of site map below)

#1 – Research Plots – Total size of Area- app.8 acres – 54 Plots @8' wide X 20 ' long plus 2' "Walk Zone" between = .25 acres
#2 - Linear Strip adjacent to Sports Fields – Amend Soil & Plant with Native shrubs, grasses, etc.
#3 – Athletic Fields (#3, 4 & 5) – Aerate & Amend at different rates
#4 - Amend Soil & Plant Grasses/Wildflowers
#5 – BMP Demonstration & Garden Trail – Various Options/Concepts



Barnegat Bay Partnership - Soil Health Initiative Team

Jakes Branch County Park - Meeting held 11/15/10 from 9:30 am -1:30 pm

Jake's Branch County Park has extensive turf areas, soccer fields, a basin, an infiltration trench in the parking lot, and various other potential landscaping areas that can provide opportunities for native plantings, rain water harvesting, pollinator gardens, etc. (Other landscaping BMPs) Investigate the possibility of resting/removing a field from use and amend and restore half of the field for a side by side comparison.

In Attendance:

Mike Mangum, OC Parks Director
Ken Pullen, OC Parks Maintenance Supervisor
Michele Urban, Jakes Branch Staff
Jason Hoger, Jakes Branch Staff
David Friedman, OCSCD
Bill Slack, OCSCD
Christine Raabe, OCSCD
Rich Mohr, RCE
Stan Hales, BBP
Jim Vasslides, BBP
Lisa Auermuller, JCNERRS
Louise Wootton, Georgian Court University
Jennifer Adams Krumins, Montclair University
Jim Murphy, Rutgers – Ag. Extension/Turf
Vicki Pecchioli, OC Planning

JAKES BRANCH COUNTY PARK – Double Trouble Road, Beachwood
Approximate 40 acres total developed portion of the site

MATES students have installed floating plant mats called "Bio-Havens"; teams of students are monitoring various components including water quality, plant succession, wildlife, etc. (see enclosed summary from MATES) They will be an on-going partner in this project and in the development of the BMP Demonstration Nature Trail.

Potential Projects:

- Native Garden Beds
- Butterfly/Pollinator (See Sample Bayscape #1 from ALS) (Appendix 2)
- Colors & Themes (from American Littoral Society's Bayscape Series)
- Rain Barrel/Rain Garden

Others as identified as by Partners.

See Enclosed Sample Concept: "Walk the Path that Water Walks" (Appendix 3)

Research Part 1 – Improvement of Soil Function in Landscape through De-compaction and Organic Matter Addition to Turf Managed Landscapes in the Barnegat Bay Watershed

Principal Investigator: Dr. James A. Murphy, Rutgers, New Jersey Agricultural Experiment Station

Overview: *Research and demonstration to determine the appropriate soil amendment application rate needed to increase the SOM (soil organic matter) for applicability to the disturbed Coastal Plain soil of Barnegat Bay watershed and existing conditions.*

Summary:

To systematically evaluate the effectiveness of adding measured amounts of various organic materials on improving and sustaining soil health as measured by infiltration by establishing test plots on selected disturbed sites on Ocean County Parks and Recreation properties, including Parks Administration, Toms River, Freedom Fields, Little Egg Harbor and Jake's Branch, Beachwood and other county-owned properties as deemed appropriate. These test plots will be tested for bulk density, SOM and infiltration rate (hydrologic conductivity) on a quarterly basis for 24 months. Data will be collected, evaluated and summarized. This will lead to an acceptable amount and type of organic material/compost to be added to disturbed Barnegat Bay/Ocean County soils.

How Compost Improves Soil and Water

- Improves soil structure and infiltration (Increasing the soil organic matter content by 1%, increases the water holding capacity of 1 acre by 16,500 gallons.)[1]
- Supplies slow-release nutrients to plants
- Holds moisture , reduces erosion, absorbs water
- Immobilizes and degrades pollutants

Numerous examples for soil amendment specifications exist throughout different parts of the United States.

Proposed Objectives: The proposed plan is to evaluate changes in soil properties and ground cover (turf performance) caused by treatments that seek to de-compact the soil and increase the soil organic matter content. To identify the appropriate method of soil preparation and restoration based on land use and existing soil conditions. Ultimately, this work will document the extent that soil function can be improved in urban landscapes.

Specific factors to be evaluated include:

1) The rate of organic matter (compost) addition to soil;
2) The effect of incorporating versus surface broadcasting the compost;
3) The effect of de-compaction with and without compost addition.
4) Assess soil health (quality) before, during and after amendments utilizing both laboratory tests (bulk density, SOM, nutrient availability), and the Barnegat Bay Soil Health Card (OCSCD/NRCS), and the Amoozemeter[2]

[1] Agresource. *Protecting Local Water Resources by Amending Soil with Compost*.

http://www.agresourceinc.com/soil_article.html > (Jan. 13, 2003).

[2] Amoozemeter is a Compact Constant Head Permeameter that can help field scientists run measurements of saturated hydraulic conductivity (Ksat) of soils and fill material at sites that previously proved to be a challenge to measure. (Appendix 4)

Proposed Objectives: Evaluate changes in soil properties and ground cover (turf performance) caused by treatments that seek to de-compact the soil and increase the soil organic matter content. Ultimately, this work will document the extent that soil function can be improved in urban landscapes. Specific factors to be evaluated include:

1) The rate of organic matter (compost) addition to soil;
2) The effect of incorporating versus surface broadcasting the compost;
3) The effect of de-compaction with and without compost addition.

Methods:

Site #1 - Physical Treatments in open field/ test plots

De-compaction (tillage) and compost incorporation into the soil will be accomplished using equipment described below. Three rates of compost application will be made; the most practical highest rate, ½ the highest rate, and no compost. Tillage treatment plots will be 8-feet wide and 28-feet long to accommodate splitting each tillage treatment (main plot) with the soil amendment treatment (compost). Each compost treatment will be separated by a 2-feet buffer with the tillage plots resulting in individual plot size of 8- x 8-feet. Each tillage treatment will also be separated by a 2-feet buffer. Each treatment will be replicated four times; therefore, the total number of plots will be 5 x 3 x 4 = 60.

The entire trial area will be seeded with tall fescue after tillage. A single application of fertilizer will be applied within 4 weeks after seeding to help establish turf. Plants nutrients will be applied uniformly to all plots based on soil testing recommendations. The trial will be initiated in August or September 2011 and monitored through 2013). All plots will be monitored for changes in soil properties and turf cover and persistence. Personnel from the Ocean County Soil Conservation District and Rutgers will monitor soil bulk density, soil organic matter content, soil nutrient content, water infiltration, and other soil properties as appropriate. The plots will also be evaluated at least four times per year (April, June, August, October) for ground cover.

Site #2 – Strip adjacent to Sports Field – amend and plant – Width 30 ‘ X length 1280 ‘ = 25600 sq.ft. = .59 acres

De-compaction (tillage) and compost incorporation into the turf-soil surface soil will be accomplished using a turf aerator and three rates of compost and three rates of OceanGro. Aeration treatments will consist of aerating either 0, 1 (spring), 2 (spring and autumn), or 4 (2 spring and 2 autumn) times per season. Compost and OceanGro will be applied after aeration at the most practical highest rate, ½ the highest rate, and none. Tillage treatment plots will be 6-feet wide and 36-feet long to accommodate splitting each aeration treatment (main plot) with the soil amendment treatment (compost & OceanGro). Individual plot size will be 6- x 6-feet. Each treatment will be replicated four times; therefore, the total number of plots will be 4 x 2 x 3 x 4 = 96. Each replication of treatments (24- x 36-feet = 864 square feet) will be position within the strip adjacent to the soccer field (3,456 square feet total area).

All other management practices will be those normally applied by the staff of Jakes Branch County Park. The trial will be initiated in March or April 2010 and monitored through 2013. All plots will be monitored for changes in soil properties and turf cover and persistence. Personnel from the Ocean County Soil Conservation District and Rutgers will monitor soil bulk density, soil organic matter content, soil nutrient content, water infiltration, and other soil properties as appropriate. The plots will also be evaluated at least four times per year (April, June, August, October) for ground cover.

Outcomes:

- **Project Report:** Results will provide specific information regarding the potential to reduce/optimize inputs for maintaining soil cover in turf landscapes. Documenting the extent of change in soil properties such as water infiltration will provide insight into the possible impact on reducing water runoff and consequently water quality issues.

Research – Part 2 - Title: Microbial Food Web Indicators under Soil Restoration

Principal Investigator: Dr. Jennifer Adams Krumins, Montclair University
Assistant Professor in the Department of Biology and Molecular Biology

Soil Micro Food Web Analysis

Microbial Community Evaluation

We will measure changes in the soil microbial community using microscopic enumeration and molecular methods. We will quantify bacterial density using acridine orange direct counts (Hobbie et al. 1977) and fungal density using hyphal length measurements (Ingham and Klein 1984). We will use DNA fingerprinting techniques to characterize both the fungal and bacterial community structure. Specifically, we will use denaturing gradient gel electrophoresis (DGGE) using primers that target the 16s region for bacteria and the ITS region for fungi. DGGE is a whole-community polymerase chain reaction (PCR) based method that creates a characteristic DNA banding pattern unique to that community's composition. This method is expedient, inexpensive and has been used extensively to characterize soil bacterial and fungal communities (Nakatsu 2007, van der Putten et al. 2007). If interesting compositional shifts in the microbial community warrant a taxa-level examination, the Department of Biology and Molecular Biology at Montclair State University has facilities for sequencing.

Soil Microfauna Evaluation

Together with the microbial community, we will sample the soil nematode community as a good indicator of soil function and health. Nematodes are highly diverse and represented at all trophic levels in a soil food web (Coleman et al. 2004). Nematodes will be counted and identified to family so that we may calculate a maturity index for the soil community (Bongers 1990). The maturity index is an established metric of soil fauna that objectively describes soil and ecosystem health.

Sampling Schedule

We will sample the soil community four times in the first year after restoration treatments have been applied. Following that, we will sample once in each year for the next two years to determine long term development of the soil community. To access soil microbial communities, we will pull mini-cores (60cc syringes with the tip cut off) from five random locations within each plot. We will aggregate the five cores into one sample. This will help normalize natural spatial variation of microbial communities in soil (Franklin and Mills 2003, Green et al. 2004, Martiny et al. 2006). From the aggregated sample we will quantify bacterial and fungal density and community composition with DGGE as described above. In conjunction with all microbial community sampling, we will extract 5cm soil cores to a depth of 10 cm. We will homogenize the cores and extract nematodes using the Cobb's sieving and extraction protocol (Seinhorst 1956).

Analysis

An ANOVA will compare bacterial, fungal and nematode density as the communities respond to the plant treatments through time. In this analysis, organism density will be the response variable while restoration treatment and time are the fixed factors. We will use multivariate ordination techniques like principle components analysis (PCA) to evaluate differences in the composition of the bacterial, fungal and nematode (maturity index) communities. For the microbes, each sample community's characteristic banding pattern will be the basis for a binary array of presence or absence of operational taxonomic units (OTU). The OTU are the variables for the PCA. For the nematodes, relative abundances of nematode taxa are the variables. A MANOVA of component scores will determine significant differences in community composition for all groups. In the case of multivariate community profiling, independent analyses will be carried out for each time point.

*** ESTIMATED MONTCLAIR UNIVERSITY BUDGET* $22,320.00 *TO BE CONFIRMED**

References Cited (Krumins)

Bongers, T. 1990. The maturity index: an ecological measure of environmental disturbance based on nematode species composition Oecologia **83**:14-19.

Coleman, D. C., D. A. J. Crossley, and P. F. Hendrix, editors. 2004. Fundamentals of Soil Ecology. 2nd Edition edition. Elsevier, Amsterdam.

Franklin, R. B. and A. L. Mills. 2003. Multi-scale variation in spatial heterogeneity for microbial community structure in an eastern Virginia agricultural field. FEMS Microbial Ecology **44**:335-346.

Green, J., A. J. Holmes, M. Westoby, I. Oliver, D. Briscoe, M. Dangerfield, M. Gillings, and A. J. Beattie. 2004. Spatial scaling of microbial eukaryotic diversity. Nature **432**:747-750.

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Martiny, J. B. H., B. J. M. Bohannan, J. H. Brown, R. K. Colwell, J. Fuhrman, J. Green, M. C. Horner-Devine, M. Kane, J. A. Krumins, C. Kuske, P. J. Morin, S. Naeem, L. Ovreas, and A.-L. Reysenbach. 2006. Microbial biogeography: putting microbes on the map. Nature Reviews Microbiology **4**:102-112.

Nakatsu, C. H. 2007. Soil Microbial Community Analysis Using Denaturing Gradient Gel Electrophoresis. Soil Science Society of America Journal **71**:562-571.

Seinhorst, J. 1956. The quantitative extraction of nematodes from soil. Nematologica **1**:249-267.

van der Putten, W. H., G. A. Kowalchuk, E. P. Brinkman, G. T. A. Doodeman, R. M. van der Kaaij, A. F. D. Kamp, F. B. J. Menting, and E. M. Veenendaal. 2007. Soil feedback of exotic savannah grass relates to pathogen absence and mycorrhizal selectivity. Ecology **88**:978-988.

Time Frame: Begin April 2011 - End June 2013

Estimated Project Budget

Personnel:	
OCSCD - Staff Support	$40,800.00*
Technical Oversight & Review (OCSCD/NRCS)	$8,000.00
Administration & Overhead	$22,500.00*
Rutgers -Agricultural Experiment Station	
Multiple Test Plots (4) at 3 locations	$10,000.00
Montclair - Summer Student support for 3 summers:	
12 weeks X 15 hours/ week X $8/hr =	$4,320.00

Partners in Education & Outreach Components:	
Rutgers Cooperative Extension	$5,000.00
JCNERRS	$5,000.00
American Littoral Society	$5,000.00
Subtotal	**$100,620.00**
Supplies & Equipment:	
Amoozemeter*- Compact Constant Head Permeameter	$3,000.00
NRCS Soil Quality Test Kits (2) X $500.00	$1000.00
Penetrometers (3) X $300	$900.00
Soil Tests Lab: 54 plots x 2 tests ($80/test)	$8,640.00
DGGE equipment (approximately)	$8,000.00
PCR supplies and costs for 3 years (specific to this work)	$10,000.00
Plant Materials – Multiple Sites (approximate)	$8,000.00
Soil Amendments	$2,500.00
Signage	$1,500.00
Miscellaneous Materials/Printing	$2,900.00
Subtotal	**$46,440.00**
Total Requested Amount:	**$142,260.00**
Match/In-Kind	
OCSCD Staff	$44,000.00*
OC, PD/P&RD Staff	$40,000.00
Equipment Use	$12,500.00
Materials (compost) & Delivery	$10,000.00
Other Partner Match	$20,000.00
Total Match:	**$126,500.00**
Total Project Amount:	**$268,760.00**

*OCSCD based on 102 total staff days at average $400/diem – Planning, coordination, field work, assessment and reporting. Technical Oversight $800/diem, Overhead & Administration based on 15% Total

Education and Outreach Components*

- **Workshops and Training Sessions:** Coordinate 2- 3 Sessions throughout the watershed for: OC Parks Maintenance Managers and Staff, Municipal Turf Managers, Athletic Field Managers, and Landscape Contractors, other BBP partners and audiences as identified. Utilize the test plots and sites to demonstrate the benefits of soil amendments and appropriate application rates and procedures, the proper site evaluation and assessment techniques and incorporate practical, field-based experiences and training. Demonstrate the use of the Soil Quality Test kits (NRCS) for site specific soil assessment.

- **Education and Outreach Materials:** Develop materials and mechanism for

information transfer appropriate to the intended audience (see above). This may include a video, PowerPoint, Weblink, or a printed/web-based "Field Guide to Soil Amendment for Barnegat Bay Watershed" to accompany the Barnegat Bay Soil Health Card.

Specific Tasks from Project Partners:

1. **Cousteau National Estuarine Research Reserve** (Lisa Auermuller)

The Jacques Cousteau National Estuarine Research Reserve (JC NERR), through the Coastal Training Program (CTP), will assist with organizing the logistics for and facilitating workshops and outreach activities associated with the project. Initially, the JC NERR will work in conjunction with the Project Team to develop clear objectives and outcomes for outreach and interpretative materials and program. Once outreach programs have been developed, the JC NERR will provide advertising and marketing support, registration support, assembly of supplemental handout materials and evaluation data on the effectiveness of the programs.

The CTP has been providing education and outreach on stormwater management technical information and best management practices for almost 10 years. Through an established relationship with the local communities, non - profits and land management agencies located throughout the Barnegat Bay Watershed, the JC NERR CTP has become known as a reliable source of credible science and research presented in an accessible format.

2. **American Littoral Society** (Helen Hendersen)

The American Littoral Society will support this project by performing much-needed outreach and education and by designing and implementing appropriate native plantings on the project site. In this way, the Society will be able to leverage their ongoing, "Bayscape for Barnegat Bay" (See sample landscape plan) program by bringing watershed residents already engaged in that effort to this project as well as by drawing in new people. Funds would support:

*Native plant garden consultant, Judy DeFiglio of Garden Guidance, to design and implement the proposed native plantings, write weekly blogs about the project before, during, and after implementation emphasizing the relationship between soil types and plants.

* Society staff (led by Atlantic Coast Project Manager, Helen Henderson) to
Perform outreach for garden implementation.
Communicate about the project through multimedia and social networking channels
Update web pages with pertinent information, fact sheets, links, photos; send out a special e- announcements about the project to our Constant Contact email lists; postings on Face Book page
Write articles for our newsletter which goes to 6,000 members, plus the NJ State Legislature and Federal congressional delegation
Incorporate information about the project into our Barnegat Bay presentations.
Lead a local field trip to the site when the project is completed.

3. **Rutgers Cooperative Extension of Ocean County** (Rich Mohr & Cara Muscio)

Incorporate the demonstration and research areas of the Jake's Branch site into the Sustainable Landscapes Education Program (SLEP).

- Translate details of the methods and cost of the projects into digital educational materials. Develop a Homeowner Fact Sheet on Amending Soil with Organic Material.
- Create a site profile of Jake's Branch for use on:
  Sustainable Landscapes Education Program (SLEP) website: http://ocean.njas.rutgers.edu
  Barnegat Bay Partnership Soil Health Webpage: www.BBP.org
  New Jersey Soil Health Website: www.njsoilhealth.org

- Provide Jake's Branch staff with relevant reference materials for use by staff at their site. Provide selected Jake's Branch staff and volunteers with invitations to participate in training opportunities normally open only to the RCE Master Gardener Program's interns and volunteers.
- Create two or more PowerPoint presentations available for use by BBP partners. One presentation would be developed for managers of community properties, the other would be developed for owners of smaller, single-residence property managers.
- Highlight the Jake's Branch project in annual SLEP site manager meetings and in local, regional, and national professional meetings such as the Environmental Stewardship Colloquium, Barnegat Bay Festival, and ANREP Conference.

Collaborate and Assist OCSCD, ALS, OCPRD, MATES, BBP & JCNERRS in developing and implementing workshops to train staff and volunteer educators and community property managers from all BBP partners (including Master Gardeners, Master Composters)

- Create and conduct a "Train the Trainer" workshop (one hour to half-day) to prepare individuals for giving both live, on-site interpretive presentations on the Jake's Branch (and other) sites in the community. Develop PowerPoint-based outreach presentations at the Extension Center, libraries or local community venues.

- Create and conduct a day-long "Site Manager & staff" workshop that covers implementing soil restoration BMPs. This would include hands-on demonstration/training of equipment used in the process, and cost/benefit details of the project to equip managers with the planning and "marketing" information they are likely to need to convince their governing boards to dedicate resources to implement soil restoration projects and practices.

Coordinate with Jake's Branch Staff to create educational projects and events for the Jake's Branch site involving RCE Master Gardener Volunteers. These might include (but not be limited to) self-guided trail brochures, audio and sign interpretive exhibits, sustainable horticulture demonstrations and festivals.

4. <u>MATES – John Wnek –</u>

MATES students will Assist in Research, Volunteers for Plantings, Future Project Development on BMP Demonstration Trail, and Educational Outreach and Presentations

<u>Currently</u>: Marine Academy of Technology and Environmental Science Students helped to plant two bio-islands in their front pond. Each pond is 25 square feet. Students planted seven types of hydrophytes to 1) determine if the bio-islands can control the nutrient levels in the pond; and 2) determine the most dominant plant(s) in the small bio-islands. Six seniors planted the bio-islands in April 2010 and measured water quality parameters including: nitrates, phosphates, temperature, pH, dissolved oxygen and carbon dioxide. Students took growth

measurements of plants including lateral and terminal growth for each plant in each bio-island. All of the parameters were measured every two weeks throughout the study period.

Students are answering questions regarding the dominance of plant growth and successional characteristics of plants. One team of students is measuring the water quality parameters and determining the factors that may have caused fluctuations throughout the spring and summer. Another team of students is comparing growth data to make a better determination of plant dominance and growth patterns.

Preliminary data indicates that nutrient levels remained constant throughout much of the study season, despite the use of fertilizers in the park. The data also showed that there were new plant and animal communities in the pond. MATES will continue to analyze the effectiveness of bio-islands using the data collected throughout the study.

As an extension, we've received a grant to purchase gas analyzing equipment for carbon dioxide (%) and oxygen (%) measurements. We would like to measure fluctuation in gases in soils and forested areas in the area. Jake's Branch Park may serve as a good study area to collect some of that type of data.

References

Additional references can be found in Appendix 5 - Draft Soil Health Literature Bibliography

Literature Review on Buffer Pollutant Removal, 2010, Dan Yu, Rutgers Water Resources, http://www.water.rutgers.edu

Sample Report: Using Compost to Improve Turf, Performance, (CODE # UC123 R3M2/09mpc4127)
Penn State's College of Agricultural Sciences on the Web: www.cas.psu.edu
This publication is available from the Publications Distribution Center, The Pennsylvania State University, 112 Agricultural Administration Building, University Park, PA 16802.

AgreSource Inc. – Applications and Specifications Manual - http://agresourceinc.com/manual.htm

The Biology of Soil Compaction
James J. Hoorman, João Carlos de Moraes Sá, and Randall Reeder, Ohio State University Extension
Columbus, Ohio. Copyright © 2009, The Ohio State University- http://ohioline.osu.edu

The Use of Soil Amendments for Remediation, Revitalization and ReUse, (59 pages) Solid Waste and Emergency response (5203P) December 2007. www.epa.gov) Results of a 3-day Soil Amendments for Ecological Revitalization Workshop- available for download at www.clu-in.org/pub1.cfm. (Saved as Christine's - EPA 542-R-07-013.pdf)

SOIL COMPACTION: HOW TO DO IT, UNDO IT, OR AVOID DOING IT
Randy L. Raper, *Agricultural Engineer and Lead Scientist*
USDA-ARS, Auburn, Alabama (a PowerPoint presentation)

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Assessing the Quality of Selected Soils from the Piedmont and Coastal Plain Regions of New Jersey
By Dr Daniel Giménez, Sung Won Yoon and Dr. Stephanie Murphy
Department of Environmental Sciences, 14 College Farm Road
(732) 932 9477, (732) 932 8644, gimenez@envsci.rutgers.edu
(File: Final Report - NRCS6828293044)

The importance of soil organic matter - Key to drought-resistant soil and sustained food and production- FAO SOILS BULLETIN 80, by **Alexandra Bot**, FAO Consultant and **José Benites,** FAO Land and Plant Nutrition Management Service
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, Rome, 2005

Achieving the Post-construction Soil Standard
For questions related to King County's post construction soil standards, Contact: Richelle Rose, DDES Land Use Services Division, E-mail – richelle.rose@kingcounty.gov

Low Impact Development – Soil Amendment Specification:
http://www.lowimpactdevelopment.org/epa03/soilamend.htm

Building Soil: Guidelines and Resources for Implementing Soil Quality and Depth BMP T5.13 in WDOE Stormwater Management Manual for Western Washington

Soil Organic Matter levels and their Interpretations, Dr. Joseph Heckman, Ph.D., Specialist in Soil Fertility, Rutgers Cooperative Extension, Vegetable Crops Edition, April 1, 2009, Volume 15., No.2.

Appendices:

1. **Photos of Areas #1-5 on Site Map**

2. **BayScape #1** – American Littoral Society

3. **Sample Concept : BMP Demonstration Area & Garden Trail**
   "Walk the Path that Water Walks"

4. **Amoozemeter** - Compact Constant Head Permeameter – Specifications and Price Sheet

5. **Draft Soil Health Literature Bibliography** – Ocean County Soil Conservation District