V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Climate Change - Water Quality & Quantity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	20%		20%	
111	Conservation and Efficient Use of Water	20%		20%	
112	Watershed Protection and Management	20%		20%	
133	Pollution Prevention and Mitigation	20%		20%	
605	Natural Resource and Environmental Economics	20%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	8.0	0.0	4.0	0.0
Actual Paid Professional	9.8	0.0	4.6	0.0
Actual Volunteer	149.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
216831	0	229923	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
763700	0	1123823	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
186731	0	688060	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Work with municipalities to help them meet their regulatory responsibilities on stormwater management and watershed restoration
- Perform experiments to investigate what the current nutrient loads are in NJ water
- Determine the best methodologies for developing Total Maximum Daily Load (TMDL) values for NJ waterways
- Examine the effectiveness of alternative onsite wastewater treatment systems
- Provide scientifically sound advice to state regulatory bodies on water quality issues
- Math modeling of contamination transport in surface and groundwaters
- Create a program comprising of faculty, staff, volunteers, industry partners and government officials

2. Brief description of the target audience

- Municipalities
- State Department of Environmental Protection
- Staff and students who gain valuable scientific experience
- Industry partners who learn ways to meet water quality standards
- Communities who learn watershed restoration methods
- NJAES Faculty and Staff involved in water research/outreach
- School age youth
- Residents

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2321	1770	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	8	36	44

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- A variety of strategies will be implemented to reach target audiences. This will include and not be limited to workshops, field visits, classes, newsletters, media releases, electronic communications,and publications.In addition a trained volunteer teaching base will be developed. Quantitative reports of participation will be collected.

Year	Actual
2012	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Short term - Knowledge of nutrient loads in various NJ waterways. Find the best methodologies for determining TDMLs
2	Medium term - To identify representative pollutants and aquifer systems in New Jersey. To develop equilibrium isotherms to quantify the adsorption/desorption kinetics for the pollutant/soil/water systems. To develop breakthrough and leaching data for the pollutant/soil/water systems.
3	Long Term - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.
4	Community-based Green Infrastructure Initiative for Urban New Jersey: Medium term - To identify representative pollutants and aquifer systems in New Jersey. To develop equilibrium isotherms to quantify the adsorption/desorption kinetics for the pollutant/soil/water systems. To develop breakthrough and leaching data for the pollutant/soil/water systems.
5	Decentralized Stormwater Management Throughout New Jersey: Medium term - To identify representative pollutants and aquifer systems in New Jersey. To develop equilibrium isotherms to quantify the adsorption/desorption kinetics for the pollutant/soil/water systems. To develop breakthrough and leaching data for the pollutant/soil/water systems.

Outcome #1

1. Outcome Measures

Short term - Knowledge of nutrient loads in various NJ waterways. Find the best methodologies for determining TDMLs

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Medium term - To identify representative pollutants and aquifer systems in New Jersey. To develop equilibrium isotherms to quantify the adsorption/desorption kinetics for the pollutant/soil/water systems. To develop breakthrough and leaching data for the pollutant/soil/water systems.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Water Quality

According to the USDA 2007 Agricultural Census, there were 183 nurseries located in Cumberland & Salem Counties. Cumberland County's 135 nurseries alone was the largest number of nurseries for any county in New Jersey and it was the fifth largest acreage in the United States. Because of the diversity of plant material and various systems of production, growers constantly search for innovative methods of optimizing their production systems in a way that maximizes output while minimizing environmental impact. Many nursery locations in both Cumberland and Salem Counties have nearby surface water areas. Protection of those areas is very important since nurseries require high quality quantities of water for production. Impacts generated from agricultural production are largely through the movement of sediment into rivers and ponds. Along with these sediments are nutrients, with phosphorus being the primary offender because it attaches to soil particles that are moved to the surface bodies of water.

What has been done

Two funded research projects ($333,681 in 2001 and $306,873 in 2005) documented that homeowners, businesses, municipalities and agricultural producers have all impacted the quality of surface waters in Cumberland County. As a result, of the Upper Cohansey Watershed research project, a river watershed restoration and protection plan was developed. Within the plan, was a section on agricultural management practices that was drafted for container and field nurseries. Funds for establishment of vegetative buffers and bio-retention structures in the Upper Cohansey watershed released in 2012 total $712,500.
A nursery survey is in its? final stages of completion. The ?Upper Cohansey Mini-grant Guide has also been completed. A ?Topics in Nursery Production? educational meeting will be held on February 20, 2013 focusing on water quality issues.

Results
Initiation of the project was in response to grower requests to identify if the nursery industry had a part in degradation of surface waters in Cumberland County. As an outcome of the project, the grower who took the lead in requesting the project has now installed a tailwater recovery system that captures, with the exception of some storm water, 100% of the water moving across the nursery. That water is also recycled, reducing the need for groundwater removal by about 40%. Another nursery is completing a major project to recapture 100% of the excess irrigation water and recycle it, thereby reducing groundwater withdrawal needs by about 50%.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #3

1. Outcome Measures

Long Term - A safe and secure water supply for all communities and industries in the state. An effective and efficient nutrient-trading program that meets the needs of industry and meets the standards set by the state regulatory bodies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual

2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Sustainable Landscaping and Stormwater Management Training for Unemployed Veterans

Many veterans are in need of educational or training opportunities for employment in the private sector. The unemployment rate for the general population has been holding steady around 9%, while that of the veteran population is 13% (US Bureau of Labor Statistics, 2011). Complicating their situation is their need for therapies to help manage a range of health issues related to their service. The therapeutic value of horticulture and employment opportunities in the landscaping industry led to a collaboration with the Department of Veterans Affairs to implement this program. The training program provides technical and experiential learning in horticulture, vegetable production, storm water management, water conservation and landscape maintenance, while providing an opportunity for veterans to become re-acclimated to the formal educational structure of a classroom. The goals of this effort are to enhance skills needed in the green jobs sector and to improve the likelihood of employment.

What has been done
In October 2008 an introductory gardening workshop was offered to 16 veterans and staff at the VA hospital in East Orange, NJ. This program led to the creation of an on-site community garden. Over the course of the past three growing seasons this garden produced in excess of 6,000 lbs of tomatoes, peppers, eggplant, collards, cabbage, kale and herbs. Vegetables were used by the VA culinary program, shared with landscape workers (veterans) as well as homeless veterans. One of the veterans used his new knowledge of horticulture to begin a successful lawncare company; his experience led the idea of developing a formal landscape training program.

In 2011 stormwater management and water conservation were added to the curriculum. The East Orange VA Hospital generates large volumes of stormwater runoff and the administrators asked for assistance with management of runoff. The veterans' training included the design and installation of a rain garden on the hospital grounds. This rain garden managed stormwater runoff from a nearby parking lot, immediately improving public access to the hospital, particularly for disabled veterans, by eliminating muddy sediments from blocking the sidewalk entrance. Rain barrels were also installed to collect roof runoff, prevent flooding, and to irrigate the community gardens.

In 2011, VA staff recruited 9 individuals for the second landscape training class. The landscape maintenance training was based on the core curriculum of the Rutgers Master Gardener training program and included fifteen 3 hour lectures, and 300+ hours of a supervised landscaping internship on the grounds of the VA/East Orange. Seven of the nine students successfully completed the training program. The VA employment counselors are working with the graduates to introduce them to employers in the landscape industry.

Results
Prior to the training program none of the veterans had considered a career in landscaping or lawncare as an option. Evaluations after program completion showed that 90% of participants felt more confident about looking for work in the landscaping field and 100% were glad that they participated in the program. Participants reported that their knowledge increased from a 2.2 to 7.8 (1 = Low, 10 = High) for landscape management and increased from a 1.3 to 8.5 (1 = Low, 10 = High) for stormwater management. The program has been judged a success by the partnering VA

staff and another class will be starting in March of 2013.

Two participants started their own landscaping businesses and one started a new community garden in Newark so he can share his new-found knowledge about gardening with local residents. The rain barrels built and installed by program participants at the East Orange VA Hospital site are preventing 9,100 gallons of stormwater per year from entering the sewer system, while providing water for the irrigation of the garden beds and greenhouse. The facility has saved $200 ($10 disposal fee/barrel) by avoiding disposal fees of the recycled plastic drums used to build the rain barrels and has reduced water usage by more than 9,000 gallons per year, resulting in additional savings.
The cistern installed at the family center in Newark can collect more than 14,000 gallons of rainwater per year to be used in the center?s community garden for plant irrigation. The center had no way to water the garden, as there is no running water at the site. The 14,000 gallons of stormwater prevention is especially important in the City of Newark, which has a partially combined sewer system that overflows often during wet-weather events.

The rain gardens built, installed, and maintained by the trainees are capturing, treating, and infiltrating 44,708 gallons of runoff per year at the East Orange VA site, resulting in the removal of 8.2 pounds/year of total suspended solids (TSS) (90% removal of 19 mg/L TSS from roof runoff), 0.041 pounds/year of total phosphorous (TP) (80% removal of 0.11 mg/L TP from roof runoff), and 0.33 pounds/year of total nitrogen (TN) (50% removal of 1.5 mg/L TN from roof runoff). [Removal rates from EPA Stormwater Menu of BMPs (Accessed August 2012) and typical stormwater concentrations are from the New York State Stormwater Design Manual (2010)].
The raised garden beds planted and maintained by program participants have produced 4,155 pounds of fresh produce (2011 and 2012) that have been donated directly to unemployed and homeless veterans with limited access to fresh vegetables.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #4

1. Outcome Measures

Community-based Green Infrastructure Initiative for Urban New Jersey: Medium term - To identify representative pollutants and aquifer systems in New Jersey. To develop equilibrium isotherms to quantify the adsorption/desorption kinetics for the pollutant/soil/water systems. To develop breakthrough and leaching data for the pollutant/soil/water systems.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Community-based Green Infrastructure Initiative for Urban New Jersey

Water and sewer infrastructure systems in many communities throughout New Jersey are reaching the end of their functional life and will need repair and replacement over the next decade. Opportunities exist to reduce costs for replacing this aging infrastructure using new techniques and technologies, better preparing the state for a sustainable future. Infrastructure planning and design approaches are needed that reduce demand on existing infrastructure, extend its functional life where possible, and provide cost-effective and sustainable solutions that conserve and protect water resources while improving the quality of life.

What has been done
Rutgers Cooperative Extension (RCE) Water Resources Program has partnered with local nonprofit organizations in urban municipalities to pilot community-based initiatives addressing environmental health issues through education programs and implementation of green infrastructure projects. The program and projects focus on priority environmental issues identified by the communities, including efforts to manage vacant properties, reduce nonpoint source water pollution, reduce combined sewer overflows and flooding, addressing the impact of brownfields on community health, and upgrade aging infrastructure. As part of the educational programs, demonstration green infrastructure projects are being constructed to capture, treat and infiltrate (where possible) stormwater runoff.

Results
Four (4) rain gardens were installed, capturing approximately 100,000 gallons of stormwater annually; 50 rain barrels were built and installed, capturing approximately 175,000 gallons of stormwater annually.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management

133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #5

1. Outcome Measures

Decentralized Stormwater Management Throughout New Jersey: Medium term - To identify representative pollutants and aquifer systems in New Jersey. To develop equilibrium isotherms to quantify the adsorption/desorption kinetics for the pollutant/soil/water systems. To develop breakthrough and leaching data for the pollutant/soil/water systems.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Decentralized Stormwater Management Throughout New Jersey

Improved stormwater management is important in New Jersey since several lakes and streams have been designated as impacted by state regulators, and stormwater can be a major contributor of pollutants to waterbodies. It is of further importance, since improved stormwater management techniques such as rain barrels and rain gardens decrease the use of potable water for irrigation, and, in the case of rain gardens, recharge groundwater aquifers. Water conservation is critical where potable water sources are taxed by multiple users including residents, businesses, landscape irrigation, and agriculture. In a larger sense, improving stormwater management is an essential tool for municipalities to help combat the potentially negative effects of climate change, such as increased flooding and more-severe droughts.

What has been done
Two Rain-barrel workshops were held in which participants were educated about the importance of decentralized stormwater management, built their own rain barrels, and then installed them at their residences or businesses. In addition, rain garden workshops were held in which participants learned about the importance of rain gardens as a tool for stormwater management. Volunteers planted and completed demonstration rain gardens.

The Stormwater Management in Your Schoolyard program educates youth about watersheds,

nonpoint source pollution, and how students can solve water issues in their communities through the use of best management practices, such as rain gardens and rain barrels. Also, a hands-on rain garden planting on the school grounds is incorporated into the educational program. The Stormwater Management in Your Schoolyard educational program was conducted at eleven (11) school systems in New Jersey.

Results
Programming resulted in environmental benefits of water conservation and water pollution prevention, as well as knowledge gain and the expectation of behavior change among program participants. Based on average installation rate of past workshop attendees, this equates to approximately 1,540,000 gallons per year of both improved stormwater management and potable water conserved. A completed rain garden is expected to manage 13,000 gallons per year of stormwater. In 2012 150,000 gallons of stormwater were captured, resulting in decreased pollutant loads to local waterbodies by retaining common pollutants such as sediment, phosphorus, and nitrogen. Evaluation of participants in the rain garden classes showed an increase in knowledge about using rain barrels for decentralized stormwater management, methods for conserving water at home, and specifics about using and maintaining rain barrels.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

See Qualitative State Defined Outcomes for Evaluation Results

Key Items of Evaluation

See Qualitative State Defined Outcomes.