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New Jersey Agricultural Experiment Station

Defining Measureable Results for Your Restoration or Monitoring Efforts or SO WHAT?

Presented to
8th Water Monitoring Summit
December 2, 2011
Pat Rector
Rutgers Cooperative Extension
Environmental and Resource Management Agent
Morris/Somerset Counties

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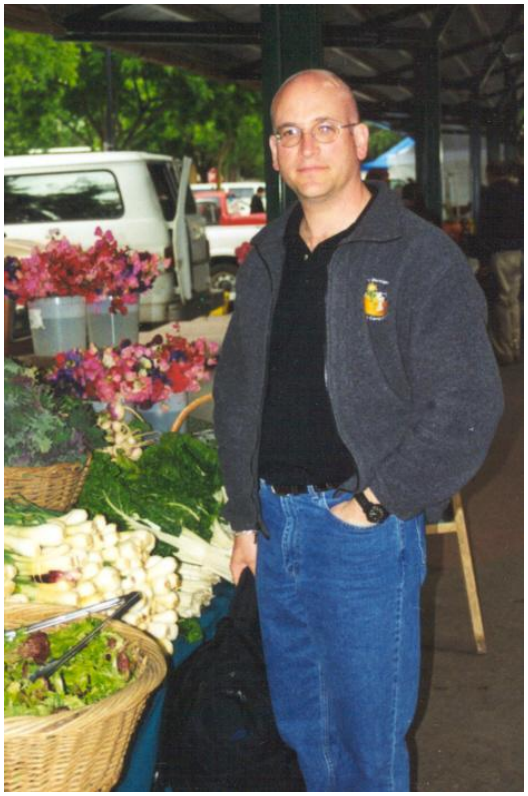
So What?



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Installation of a vegetated swale at the DPW

Rutgers Water Resources Program received 319(h) funding to implement stormwater management practices in the Troy Brook Watershed. Swale receives runoff from 1.6 acres of parking lot. Soil at the site shows impact of fueling station in the parking lot. Rutgers Water Resources Program paid for basic soil test for hydrocarbons.

Based on literature research specific plants that fulfilled the bioswale design requirements and pollutant removal requirements were planted. Big bluestem, switchgrass and rye (pictured here) are plants identified to remove hydrocarbons. Rye and switchgrass were planted in abundance.

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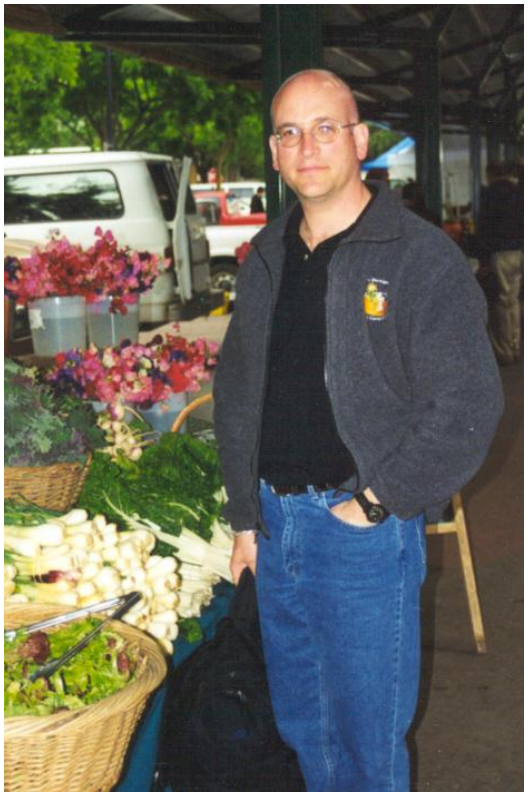
So What?



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JUNE 11, 2011
TROY BROOK BUS TOUR

Rutgers Professor, Dr. Chris Obropta, P.E., Director Rutgers Water Resources Program, will lead the tour. Dr. Obropta has been a leader in the stormwater management field for more than 20 years. He and his team developed the Troy Brook Regional Storm Water Management Plan that forms the basis for the implementation that is occurring in this watershed. Dr. Obropta will bring the Best Management Practices (BMPs) to life as we travel the watershed.

Whippany River Watershed Action Committee Presents:

Pamphlet created by Pat Rector, Rutgers Cooperative Extension. Environmental and Resource Management Agent Morris/Somerset Counties .

Department of Public Works
Vegetated Swale

Vegetated swales achieve higher pollutant removal with slight slopes, permeable soils, dense grass cover, increased contact time of the water with the plants and soil, and during smaller storm events.

TABLE 1 EFFECTIVENESS OF DESIGN SWALES

Pollutant	Median % Removal
Total Suspended Solids	81
Oxygen Demanding Substances	67
Nitrate	38
Total Phosphorus	9
Hydrocarbons	62
Cadmium	42
Copper	51
Lead	67
Zinc	71

US EPA Storm Water Technology Fact Sheet Vegetated Swales 832-F-99-006 September 1999

As with all BMPs maintenance is the key factor in continuing performance. Maintenance includes: maintaining a dense, healthy grass cover, periodic mowing (grass never cut shorter than design flow depth), weed control, watering during drought conditions, reseeding of bare areas, clearing of debris, and removal of accumulated sediment. Minimal use of fertilizers and pesticides is recommended. The channel should be maintained. (US EPA 1999).

Department of Public Works– Vegetated Swale: The rip rap outlet

Chris and Jillian Thompson putting up silt fence. Photo by Pat Rector May 2011.

Troy Brook just behind the site for the swale. Photo courtesy Pat

What does hand placing the rip rap mean?. Photo courtesy Pat Rector May 2011

Photo close-up of Blue-flag Irises at top of the outlet. Photo by Ingrid

A considerable amount of settling and slowing of velocity will occur in this rip rap apron. The buffer of switchgrass will help to filter pollutants including hydrocarbons.

Photo of the outlet. Photo by Ingrid Witty May 2011.

Department of Public Works Swale: The channel

Laying jute Photo by Pat Rector May 2011.

The rye seeds. Photo by Pat Rector May 2011.

Chris does some PhD work.. Photo courtesy Ingrid Witty May 2011

Everyone grab a rake. Photo courtesy Pat Rector May 2011

Photo check dam. Photo by Pat Rector May 2011.

Photo of the channel. Photo by Ingrid Witty May 2011.

Department of Public Works—Vegetated Swale: The berm

Adding soil for the berm. Photo by Pat Rector May 2011.

Almost the length of the berm. Photo courtesy Pat Rector May 2011

Soil in the berm. Photo courtesy Pat Rector May 2011

Photo berm. Photo by Ingrid Witty May 2011.

Big bluestem	*Bouteloua curtipendula*
winter rye	*Sicale cereale L.*
switchgrass	*Panicum virgatum*

These three plants were noted, among others, in Fricke et al. as significant for ability to remove hydrocarbons from soil in Assessment of Phytoremediation as an in-situ technique for cleaning oil contaminated sites. The above three plants: big bluestem, winter rye, and switchgrass were planted in the DPW vegetated swale. The soil from the berm has been sent for testing for hydrocarbon content with Rutgers Cooperative Extension internal funds. Post testing of the soil will be conducted.

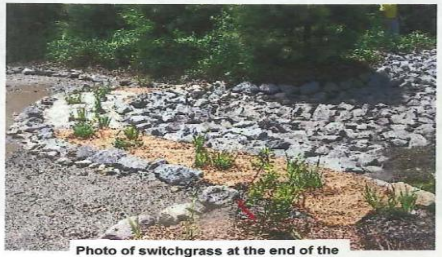

Photo of switchgrass at the end of the berm. Photo by Ingrid Witty May 2011.

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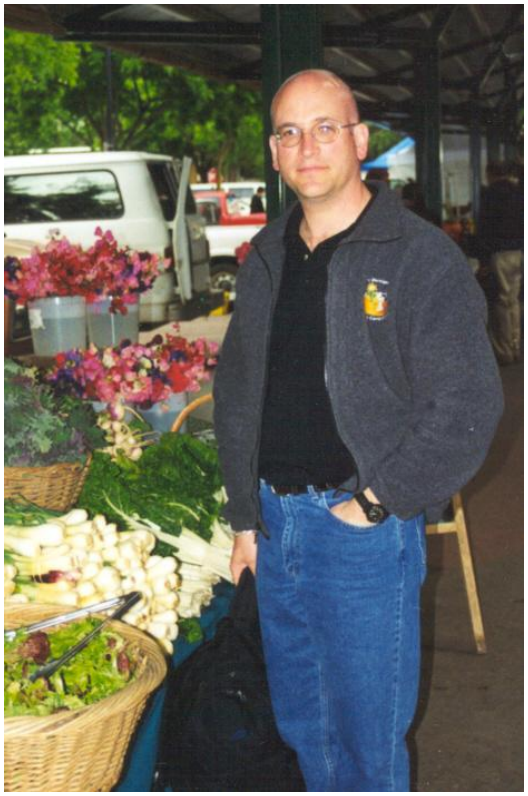
That's Nice! So What?



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Results

One new Thing you Learned:
It's surprising when you realize that besides parking lots, the roofs of houses also redirect water from rain fall.
Learned how close the river is to the town DPW and garbage trucks
We don't want rainwater entering the sewer system
Rain water should be put back into the ground, not into sewers.
Rain gardens can be located almost anywhere
Benefits of a network of residential rain gardens

- Change in Behavior – (n=8)
- 50%(4) None;
- 25% (2)spoke about what they learned to neighbors;
- 12.5% (1) spoke to Town Council about what they learned.
- 12.5% (1) will pay better attention to runoff
- { The survey was short term within 1 month after bus tour}

Is your message clear?

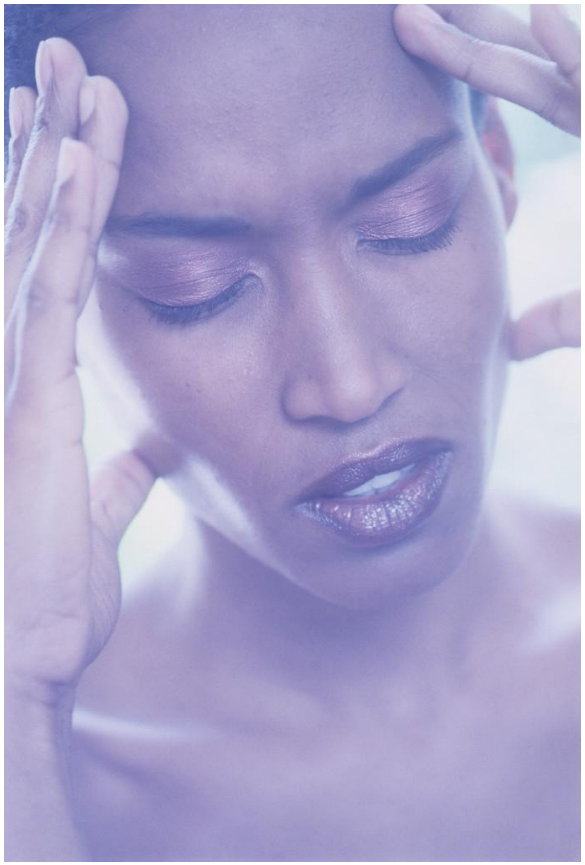
Occupywallstreet.org

One person learned that the stormwater practices helped to keep rocks out of the stream.

- Objectives clear
- Message clear
- Do you know what they heard?
- Do you know what they think?
- Do you know what they did?

Peters Brook Rain Barrel Workshops

Quality Assurance Project Plan



- What is the critical word?
- PLAN
- At Rutgers if we are going to ask “human subjects” questions, we have to submit a plan and receive IRB approval.
- Like QAPP approval it makes my head hurt, BUT
  - It makes me think about what my objectives are, if what I am asking will help me achieve those objectives, when I will ask the questions, exactly what questions I will ask, et al.

WHY DO I VOLUNTEER TO MAKE MY HEAD HURT?

1) So that when Dan asks me “So What?” I can answer him
2) Because the data I obtain is relevant to the questions that are important to me and to others.

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Heather sampling August 4, 2010
Walck Park, Somerville, NJ

Habitat Types Present (check all that apply)

☐ Fine woody debris	☐ Submerged Logs
☐ Leaf Packs	☐ Cobble
☐ Boulders	☐ Coarse Gravel
☐ Vegetated Bank Margins	☐ Other

River Bottom Composition (must = 100)

____ % Sand	____ % Silt
____ % Organic	____ % Gravel
____ % Cobble	____ % Boulder
____ % Bedrock	____ % Other

Macroinvertebrate Collection

Separate the macroinvertebrates into the different groupings listed in the table below. Check the box to the left of each group present in your sample. Record the number of organisms present in each group on the line to the right (see example). Each column represents a different tolerance category (pollution intolerant, pollution sensitive, and pollution tolerant). Count the number of checks present in each column and record the total number of checks in the box below the column. Next, multiply the total number of checks in each column by the indicated value. Add the final numbers from each column to find the index value. Use this number to find the water quality rating of the site.

Pollution Intolerant		Pollution Sensitive		Pollution Tolerant	
Example: ☒ Mayfly	23	☐ Net Spinning Caddisfly	8	☐ Black Fly	
☐ Mayfly		☐ Alderfly		☐ Midge Fly	5
☐ Stonefly		☐ Damselfly		☐ Lunged Snails	
☐ Caddisfly not net spinners	7	☐ Dragonfly	1	☐ Aquatic Worms	3
☐ Dobsonfly/Fish Fly		☐ Crane Fly		☐ Leeches	53
☐ Watersnipe Fly	1	☐ Sowbugs			
☐ Riffle Beetle	4	☐ Scud	7		
☐ Water Penny		☐ Crayfish			
☐ Gilled Snails		☐ Clams/Mussels			
3 # of checks * 3 =	9	3 # of checks * 2=	6	3 # of checks * 1 =	3

Add the three calculated numbers together to find your total index value and rate your stream using the rating values below.

Total Index Value ____

Water Quality Rating

____ Excellent (>22) 18 Good (17-22) ____ Fair (11.16) ____ Poor (<11)

Observations ____

Photos are always helpful – please attach them with descriptions.

Power to discern a difference based on installation of small BMPs?

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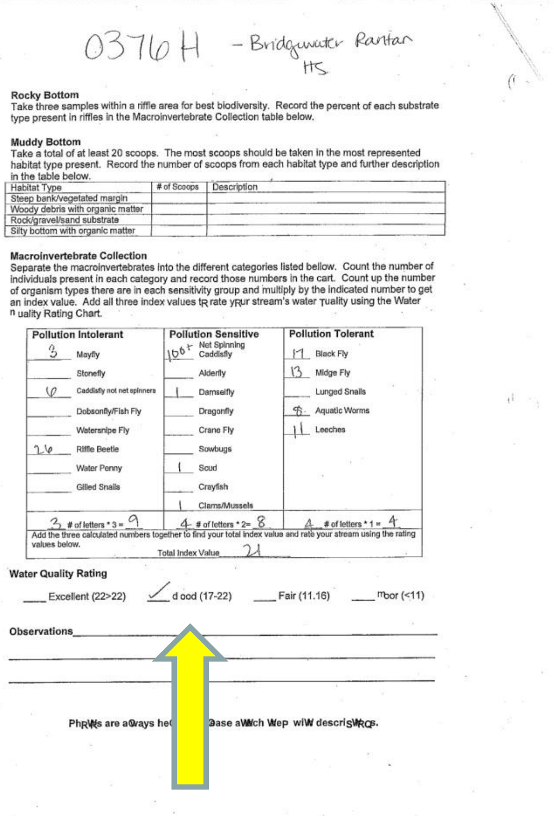


0376H – Bridgewater Raritan HS

Rocky Bottom
Take three samples within a riffle area for best biodiversity. Record the percent of each substrate type present in riffles in the Macroinvertebrate Collection table below.

Muddy Bottom
Take a total of at least 20 scoops. The most scoops should be taken in the most represented habitat type present. Record the number of scoops from each habitat type and further description in the table below.

Habitat Type	# of Scoops	Description
Steep bank/vegetated margin		
Woody debris with organic matter		
Rock/gravel/sand substrate		
Silty bottom with organic matter		

Macroinvertebrate Collection
Separate the macroinvertebrates into the different categories listed below. Count the number of individuals present in each category and record those numbers in the cart. Count up the number of organism types there are in each sensitivity group and multiply by the indicated number to get an index value. Add all three index values to rate your stream's water quality using the Water Quality Rating Chart.

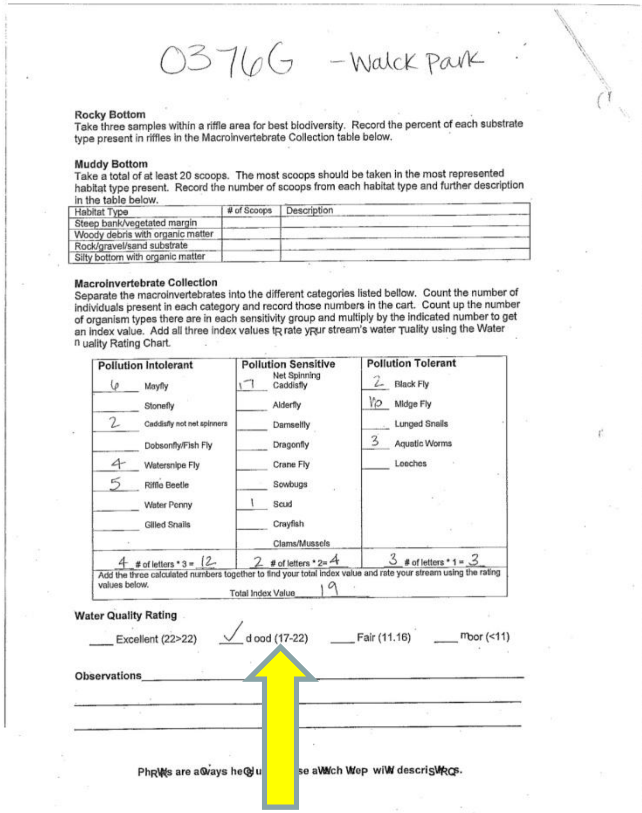
Pollution Intolerant		Pollution Sensitive		Pollution Tolerant	
3	Mayfly	100+	Net Spinning Caddisfly	17	Black Fly
	Stonefly		Alderfly	13	Midge Fly
6	Caddisfly not net spinners	1	Damselfly		Lunged Snails
	Dobsonfly/Fish Fly		Dragonfly	5	Aquatic Worms
	Watersnipe Fly		Crane Fly	11	Leeches
26	Riffle Beetle		Sowbugs		
	Water Penny	1	Scud		
	Gilled Snails		Crayfish		
		1	Clams/Mussels		
3 # of letters * 3 = 9		4 # of letters * 2 = 8		4 # of letters * 1 = 4	

Add the three calculated numbers together to find your total index value and rate your stream using the rating values below.
Total Index Value 21

Water Quality Rating
___ Excellent (22>22) ✓ Good (17-22) ___ Fair (11.16) ___ Poor (<11)

Observations___

Photos are always helpful. Please attach them with descriptions.



0376G – Walck Park

Rocky Bottom
Take three samples within a riffle area for best biodiversity. Record the percent of each substrate type present in riffles in the Macroinvertebrate Collection table below.

Muddy Bottom
Take a total of at least 20 scoops. The most scoops should be taken in the most represented habitat type present. Record the number of scoops from each habitat type and further description in the table below.

Habitat Type	# of Scoops	Description
Steep bank/vegetated margin		
Woody debris with organic matter		
Rock/gravel/sand substrate		
Silty bottom with organic matter		

Macroinvertebrate Collection
Separate the macroinvertebrates into the different categories listed below. Count the number of individuals present in each category and record those numbers in the cart. Count up the number of organism types there are in each sensitivity group and multiply by the indicated number to get an index value. Add all three index values to rate your stream's water quality using the Water Quality Rating Chart.

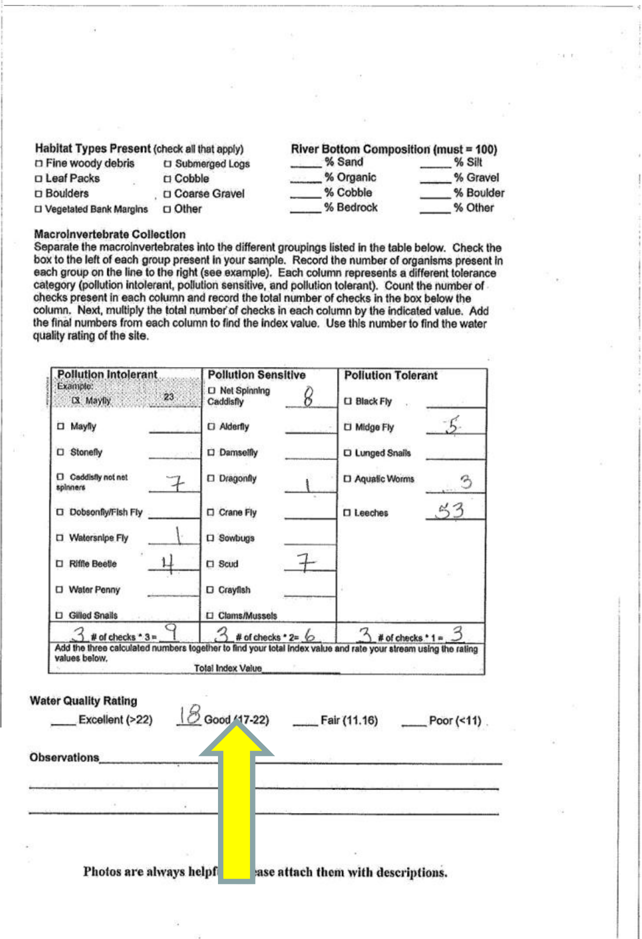
Pollution Intolerant		Pollution Sensitive		Pollution Tolerant	
6	Mayfly	17	Net Spinning Caddisfly	2	Black Fly
	Stonefly		Alderfly	10	Midge Fly
2	Caddisfly not net spinners		Damselfly		Lunged Snails
	Dobsonfly/Fish Fly		Dragonfly	3	Aquatic Worms
4	Watersnipe Fly		Crane Fly		Leeches
5	Riffle Beetle		Sowbugs		
	Water Penny	1	Scud		
	Gilled Snails		Crayfish		
			Clams/Mussels		
4 # of letters * 3 = 12		2 # of letters * 2 = 4		3 # of letters * 1 = 3	

Add the three calculated numbers together to find your total index value and rate your stream using the rating values below.
Total Index Value 19

Water Quality Rating
___ Excellent (22>22) ✓ Good (17-22) ___ Fair (11.16) ___ Poor (<11)

Observations___

Photos are always helpful. Please attach them with descriptions.



Habitat Types Present (check all that apply)
- ☐ Fine woody debris ☐ Submerged Logs
- ☐ Leaf Packs ☐ Cobble
- ☐ Boulders ☐ Coarse Gravel
- ☐ Vegetated Bank Margins ☐ Other

River Bottom Composition (must = 100)
___ % Sand ___ % Silt
___ % Organic ___ % Gravel
___ % Cobble ___ % Boulder
___ % Bedrock ___ % Other

Macroinvertebrate Collection
Separate the macroinvertebrates into the different groupings listed in the table below. Check the box to the left of each group present in your sample. Record the number of organisms present in each group on the line to the right (see example). Each column represents a different tolerance category (pollution intolerant, pollution sensitive, and pollution tolerant). Count the number of checks present in each column and record the total number of checks in the box below the column. Next, multiply the total number of checks in each column by the indicated value. Add the final numbers from each column to find the index value. Use this number to find the water quality rating of the site.

Pollution Intolerant		Pollution Sensitive		Pollution Tolerant	
Example: ☒ Mayfly	23	☐ Net Spinning Caddisfly	8	☐ Black Fly	
☐ Mayfly		☐ Alderfly		☐ Midge Fly	5
☐ Stonefly		☐ Damselfly		☐ Lunged Snails	
☐ Caddisfly not net spinners	7	☐ Dragonfly	1	☐ Aquatic Worms	3
☐ Dobsonfly/Fish Fly		☐ Crane Fly		☐ Leeches	53
☐ Watersnipe Fly	1	☐ Sowbugs			
☐ Riffle Beetle	14	☐ Scud	7		
☐ Water Penny		☐ Crayfish			
☐ Gilled Snails		☐ Clams/Mussels			
3 # of checks * 3 = 9		3 # of checks * 2 = 6		3 # of checks * 1 = 3	

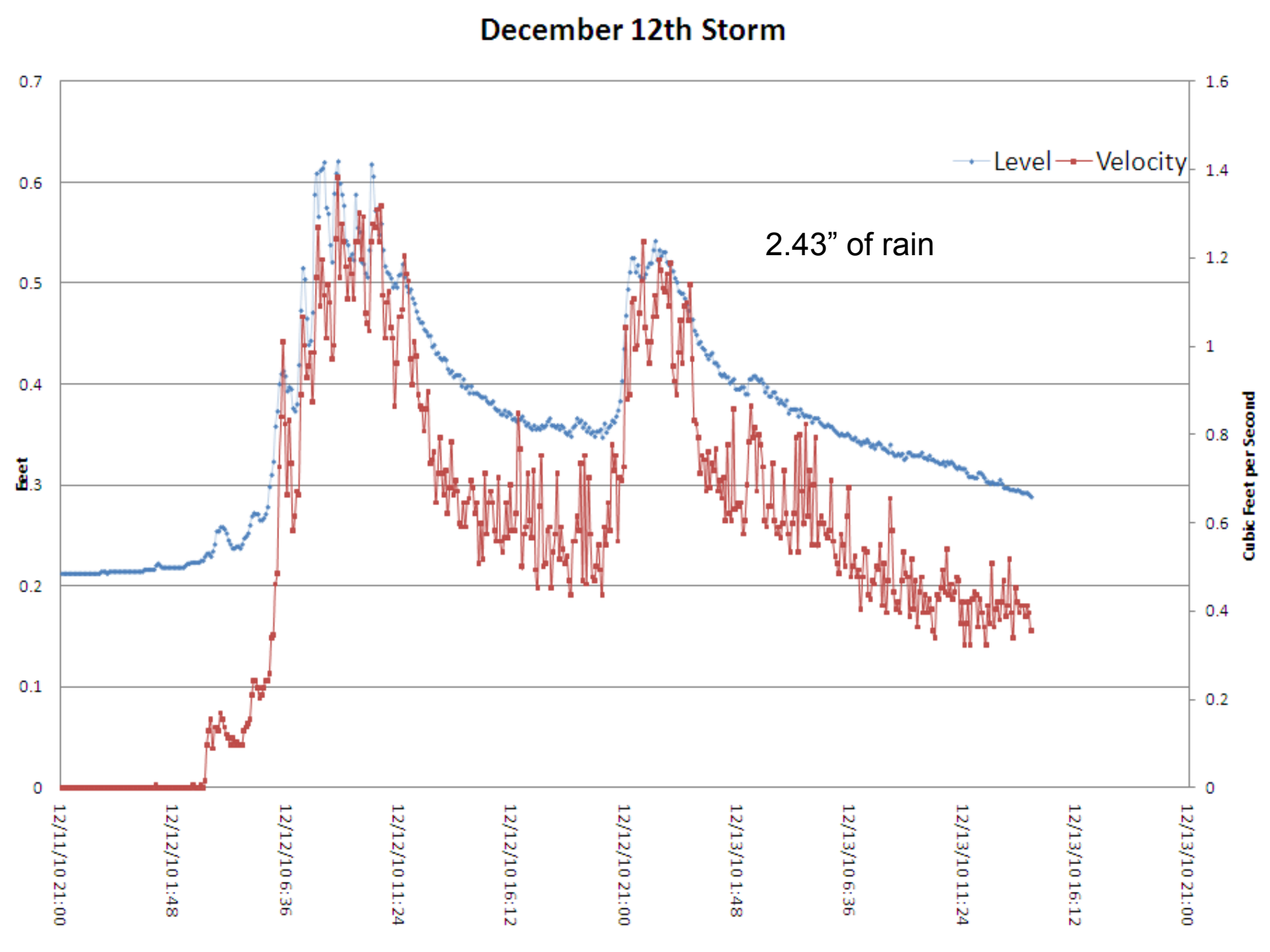
Add the three calculated numbers together to find your total index value and rate your stream using the rating values below.
Total Index Value___

Water Quality Rating
___ Excellent (>22) 18 Good (17-22) ___ Fair (11.16) ___ Poor (<11)

Observations___

Photos are always helpful. Please attach them with descriptions.

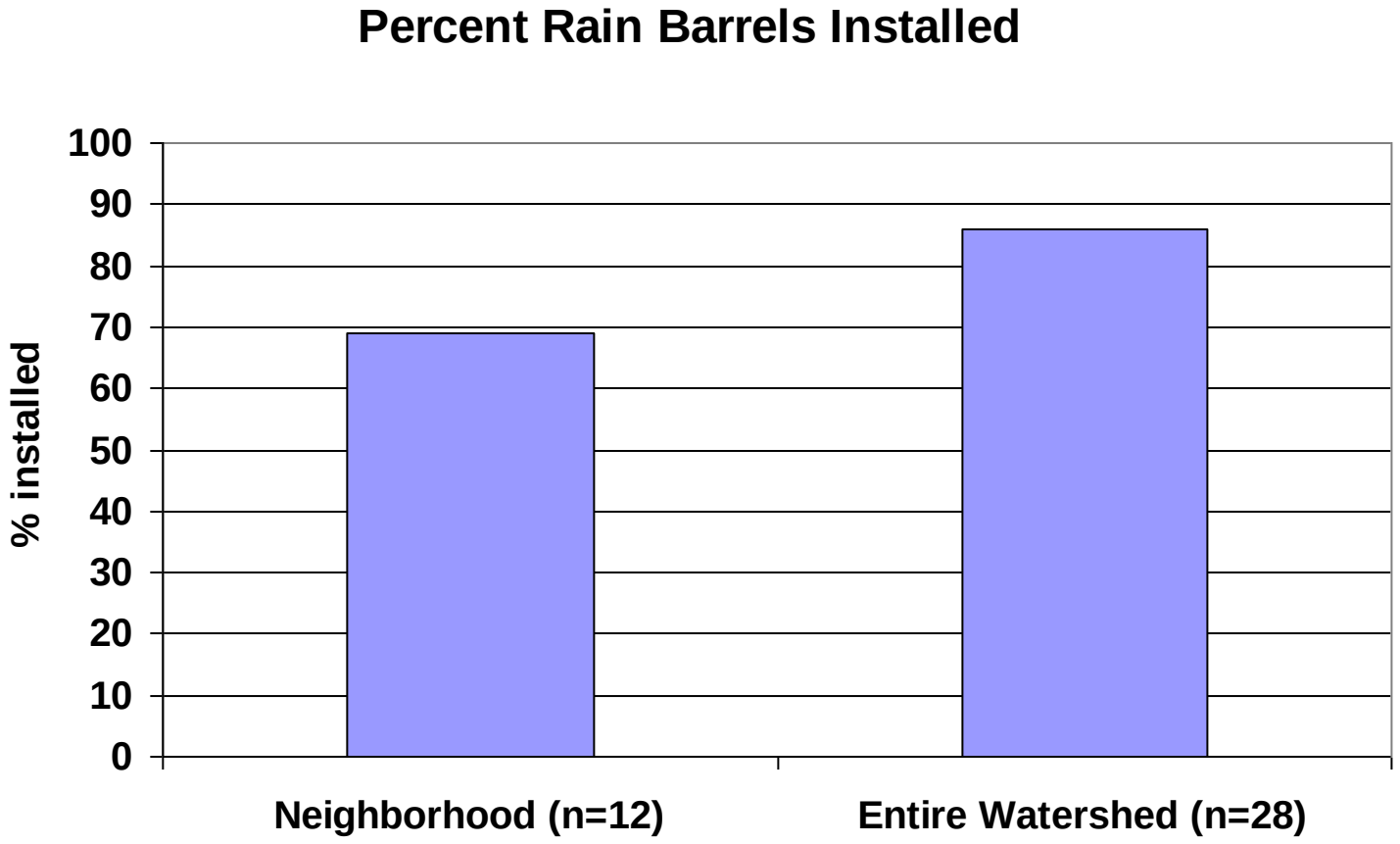
I am not convinced that it will.


December 12th Storm
Level
Velocity
2.43” of rain
Feet
Cubic Feet per Second
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
12/11/10 21:00
12/12/10 1:48
12/12/10 6:36
12/12/10 11:24
12/12/10 16:12
12/12/10 21:00
12/13/10 1:48
12/13/10 6:36
12/13/10 11:24
12/13/10 16:12
12/13/10 21:00

Limitations

- Stingray collected measurable data for each storm
- Sensor constantly sits in 2.5” of water, or 0.2’, measured and recorded for periods of dry weather
- Limited to non-turbulent water
- Turbulence causes zero data points, gaps in the hydrograph
- Data had to be filtered, any measurements below 0.2’ were removed

Installation Rates based on survey responses



Peters Brook Response Rate 34%

Statewide numbers 71% installation n=138

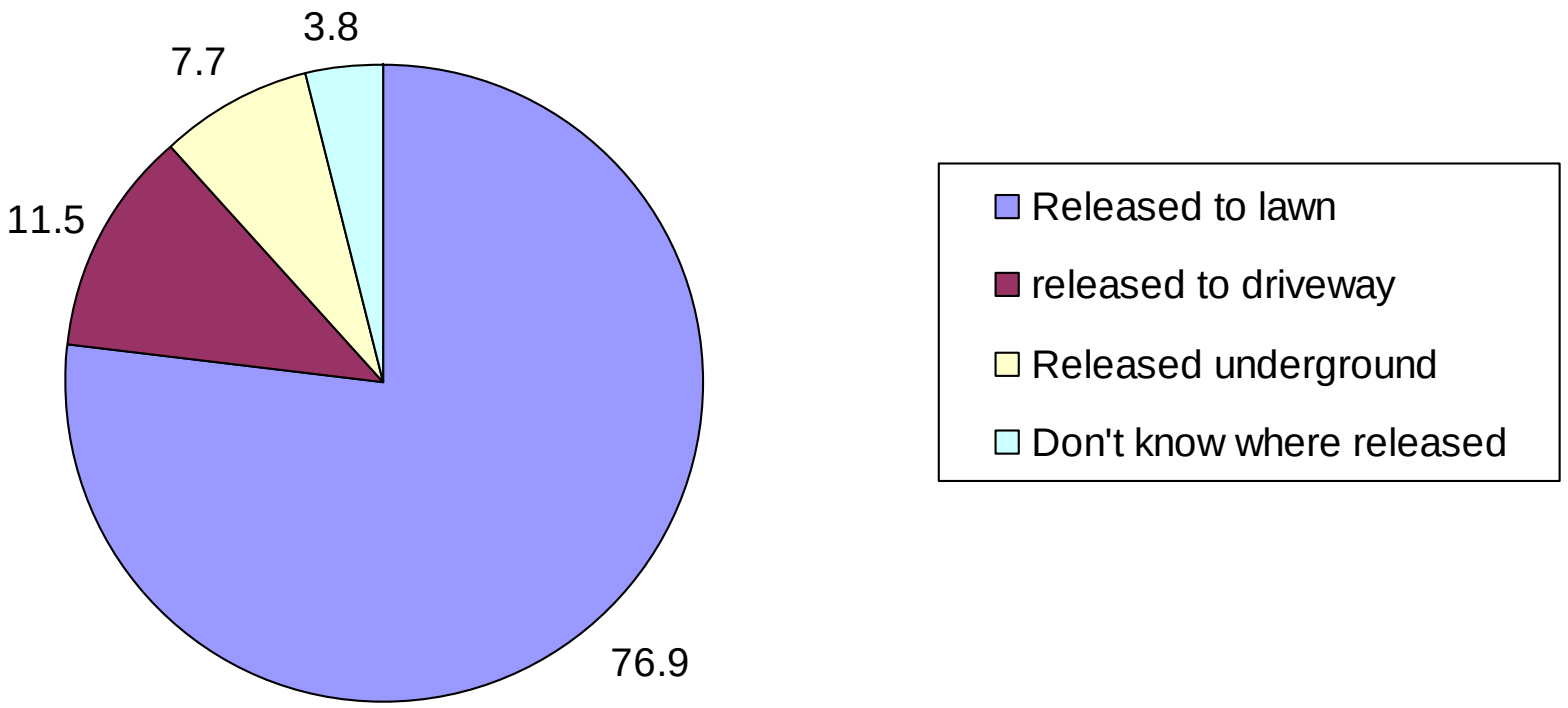
Evaluation = purposeful inquiry

- "Judge a man by his questions rather than his answers."
- −Voltaire

- "Pay attention to the questions you need to ask, not the answers you want to hear."
- −Leonard Hirsch, American consultant

- Slide from University of Wisconsin Extension, Evaluation Documents Power Point Slides Set 4

Type of downspout disconnection (%)



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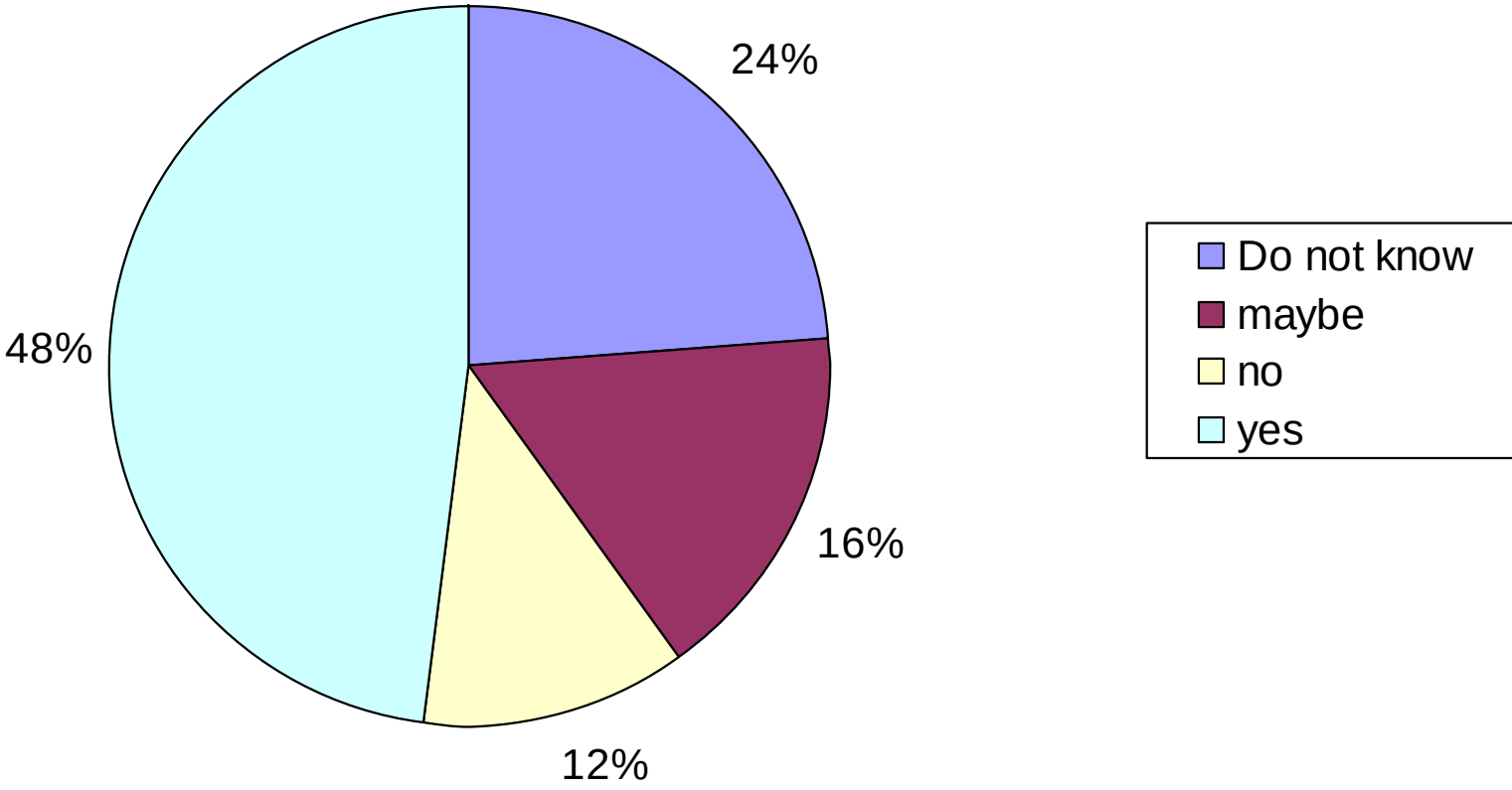
Interest to install rain garden



Results

Somerville – 130 total houses	Roof Runoff	
Scenario	**cu. Ft.**	**% Reduction**
Baseline	75,300	-
10%	72,468	4
25%	68,254	9
50%	61,758	18
100%	39,807	**47**
100% Disconnection		
10%	70,360	7
25%	62,920	16
50%	50,558	33
100%	25,818	**66**
Disconnection and Barrels		
10%	68,787	9
25%	53,978	28
50%	43,114	43
100%	11,698	**84**

Bridgewater – 200 total houses	Roof Runoff	
Scenario	**cu. Ft.**	% Reduction
Baseline	305,411	-
10%	294,780	3
25%	284,441	7
50%	266,923	13
100%	134,191	**56**
100% Disconnection		
10%	278,509	9
25%	248,420	19
50%	198,252	35
100%	104,798	**66**
Disconnection and Barrels		
10%	275,418	10
25%	243,187	20
50%	187,811	39
100%	84,059	**72**

Evaluations

- Evaluate verb 1) to determine or set the value or amount of; appraise *to evaluate property* : 2) to determine the significance or quality of; assess *to evaluate the results* 3) to ascertain the numerical value of (a function, relation, etc.)
- Evaluation noun 1) an act or instance of evaluating or appraising 2) a diagnosis or diagnostic study of a physical or mental condition.

- Websters Universal College Dictionary

What does your audience want?

- They care about clean water.
  - This is taken from Mahler et al, 2010 Journal of Extension article http://www.joe.org/joe/2010april/rb2.php
- Yes they do. A random survey was sent to adult residents of Alaska, Idaho, Oregon and Washington with a target goal response of 900 completed questionnaires (50%).
- 2007 survey results rated the following as very or extremely important: drinking water -99%; clean rivers -94%; clean groundwater -93%

Who/What/Why/How?

- Who wants to know- me/ funders/ county officials/ stakeholders
- What do they want to know – is my program accomplishing objectives?/is this a program worth funding?/is there anything going on here that is newsworthy?/what is going on that impacts my world?
- Why – to improve program/ to determine if there is a reason to fund this program/ to see what is being done in the county/ to learn about what is going on in my town/watershed
- How will they use the information – to improve the program/ to fund or not to fund/ to talk about what is going on/ to maybe assist in some way with the work we do and to become educated about the water quality problems in their town/watershed.

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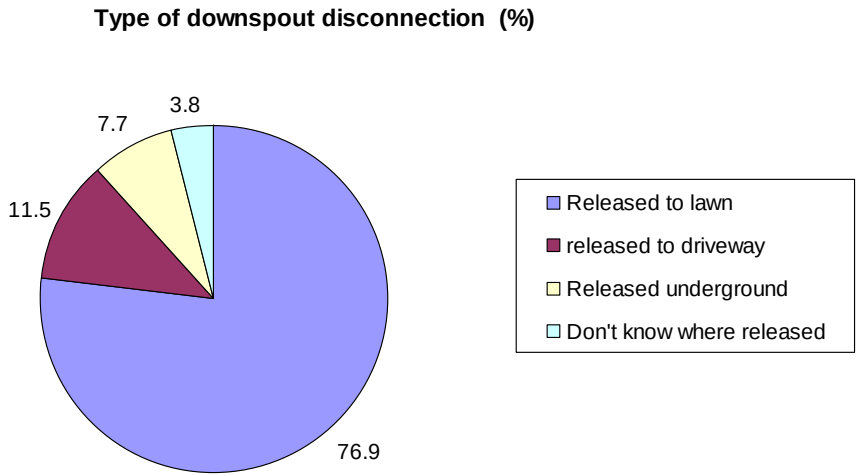
But in the same survey

- Q: Since January 2002, which of the following learning opportunities have you taken advantage of for water quality issues?" Answered by 1,012 residents of the Pacific Northwest in early 2007. From Mahler et al, 2010 Journal of Extension article http://www.joe.org/joe/2010april/rb2.php

- 60% read newspaper, watched TV or read printed fact sheet or bulletin
- while 18% visited a web site for information and less than 10% attended short course, or watched video
- College graduates were as likely to avail themselves of the newspaper as those with high school education although more likely to utilize the web.
- **Preferred** learning was fact sheets #1 (62%) versus web site (32%).

Why are follow up surveys important?

Figure 7. Backyard Stream: Rock Banks, Grass to Stream Edge, Straightened Channel, and Symmetrical Plantings Installed by Streamside Neighbors in the Name of "Stream Enhancement."



Changing mid-stream

- If you find something the next step is investigate: not stop in the middle of a jump.
- Determine why goals or objectives

  are not being met. Look for ways to

  achieve the original goals or refine the objectives.

Evaluations

- What is the purpose of the evaluation?
- Who will use the information? How will they use the information?
- What question does the evaluation seek to answer?
- How will you collect the information? When will you collect the information?
- How will you report and use your findings? Like any data it does not help if it just sits in an Excel sheet.
  - From Evaluation Documents on Program Development and Evalution, by University of Wisconsin Extension. Http://www.usex.edu/ces/pdande/evaluation/index.html

- Sound like a QAPP to you? It does to me.

What type of questionnaire?

- Web based survey? Survey monkey
- Mail survey
- E-mail survey
- Phone survey
- In-person survey

- Know your audience

What are you looking for?

- Again remember the QAPPs
  - What are you looking for?
  - Improved water quality?
  - How will you know it when you see it? Phosphorus <0.5mg/L That is a specific quantity that you are using to register improved water quality.

How will you know a measureable outcome when you see it? You need to define it. Are you looking for a change in behavior? An actual adoption? How will you measure it? What indicators can you develop to determine change in behavior or adoption of new practices that will improve water quality?

Installation rate of rain barrels compared to the state average.

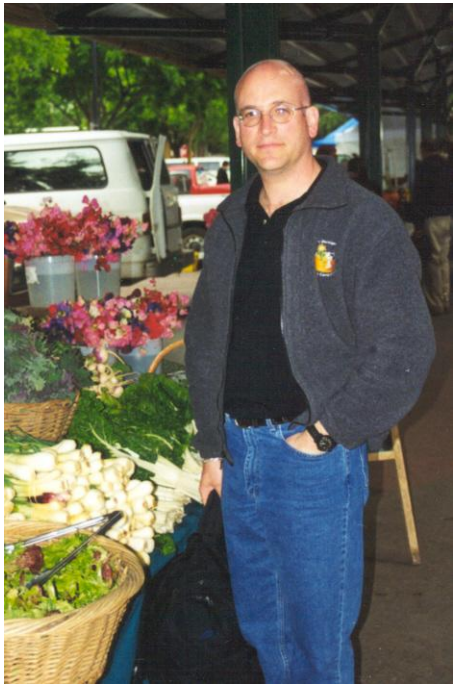
Estimate of volume of captured runoff

Number of participants who increased their knowledge by 50% (Note not a change in behavior, }

Change in behavior

- Not easy
- Hard to measure
- Name of the game,
- One rain barrel will never improve water quality

Questions?



Just kidding

Please contact,
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