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Mary Adamo Robertson

Robert A. Robertson

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“Assessing Homeowner Risk and Knowledge in Mitigating Nonpoint Source Pollution in Coastal Watersheds”

Mary Adamo Robertson and Robert A. Robertson, Ph.D.

Introduction

In recent years, the population within New England and other coastal areas in the United States has grown and is expected to continue in the future. Much of this growth occurred in rural and suburban areas north of Providence, RI and into southern New Hampshire and Maine (Robinson et al., 2004, pp4-5). The trend of increasing urbanization has led to diminished surface and ground water quality in watersheds throughout the northeast and in other parts of the country. Subtle evidence of diminishing coastal water quality is observed through periodic episodes of eutrophication events such as “red tides” and other water quality warnings. For many individuals, the impacts of these episodes are limited and may only be experienced as a temporary nuisance, for example a beach closure or other marine-based restrictions, even though these events are symptomatic of larger ecological problems. We hypothesize that many individuals do not make the connection between household activities, such as consumptive water use, the application of fertilizers and pesticides on landscaped areas, other household activities and regional water quality. Moreover, in order to develop and administer public policies to mitigate the impacts of nonpoint source water pollution from household activities, it is essential to gain an understanding of residents’ level of knowledge, attitudes and preferences with respect to consumptive water use, household activities and water quality.

Although residential water use, septic and wastewater treatment systems are considered to be a significant source of nonpoint source pollution, there is little in the literature that explores the linkages between household water use and water quality. Of interest, is the related literature on residential water demand which explores the relationship between residential water demand as a function of price and other socioeconomic variables. Much of this literature focuses on estimating the responsiveness of residential demand to a small change in price¹; however, the literature reveals a wide range of estimates and thus there is no consensus as to which estimate is best. This is in part due to the fact that the estimated responsiveness of water demand to price is largely determined by the researcher’s assumptions, model choice and data limitations. The general findings from this literature indicate that: water price is the primary instrument to control demand; the responsiveness of demand to a change in price is higher at lower household income levels because at lower income levels, the cost of water makes up a larger proportion of the overall household budget; and other variables such as housing characteristics, number of household members and education are significant in determining water demand (Arbues et al., 2003).

Rural households that supply their own water via a private well do not pay a regular utility bill which implies that they face a zero per-unit cost of water². As such, water pricing policies are not applicable to motivate a change in behavior to increase water conservation and mitigate regional nonpoint source water pollution. Instead, homeowners may incur a lump sum investment cost to replace or upgrade their existing

¹ Generally referred to in the economics literature as the price elasticity of demand.

² Excluding the cost of electricity needed to pump the water from the ground.

well and/or septic system at some uncertain date. Because the cost to upgrade or replace these systems can be prohibitively expensive, homeowners have an incentive to take the appropriate measures to avert these costs by prolonging the life of their systems through preventative measures. In addition, septic systems which are properly maintained and in good working order are less likely to generate negative unintended impacts such as excessive nutrient contributions to local surface and ground water systems. Absent in the literature is research that examines the relationship between water use and environmental quality at the household level. It is important to explore these two topics jointly since household's water use and activities directly influence regional water quality even though each household's contribution may be small relative to the overall water quality problem; it is the resulting cumulative impact that warrants further attention at the household level.

Objectives

The objectives of this research are fourfold. First, we will develop and conduct a mail survey of household residents to assess their level of information with respect to their household water use and perceptions of regional water quality, identify their household practices and activities surrounding household water use and land management, collect demographic and economic data that will be used to characterize the households and identify their preferences and attitudes about potential water and environmental conservation initiatives. Second, using household survey data and ground water quality data obtained from University of New Hampshire Department of Natural Resources and the Water Resources Research Center, estimate a spatially distributed statistical model of ground water quality as a function of household, socioeconomic and environmental characteristics. Third, explore attitudes and preferences of household residents with respect to risk, defensive behavior and water quality. In particular, we are interested in examining whether the preferences for water quality and level of defensive behavior exhibited by households differ among those with private water systems (i.e. well and septic) versus those who receive public water and wastewater treatment services. Fourth, prepare a final report that analyzes and details the findings of the household survey and statistical analysis assessing homeowner risk and knowledge in mitigating nonpoint source pollution in coastal watersheds. Although not specifically mentioned in this proposal, we hope that the results of this research may be used in the future as part of a mathematical programming model to examine the impacts of changes in household behavior on water quality using mathematical programming simulations.

Preliminary Results and Progress to Date

Due to last minute personnel changes, the project has not been completed as of this report deadline. However, significant progress has been made to meet the objectives of the project. A list of 3000 residents within the 9 towns of the Lamprey River Watershed has been compiled, including a database of riparian abutters including, names, addresses and acreage. Following a review of the watershed study literature and interviews with local planners a mail survey was produced using a web based survey design. The survey has been pre-tested for clarity, content and respondent burden and is currently being reviewed by the UNH Office of Sponsored Research. The mail survey will be distributed August 1, 2006 to 3,000 residents in the nine watershed communities.

The Lamprey River Watershed Study: A watershed is an area of land where all water from the area drains into a stream, river, lake or other water body. The Lamprey River Watershed is only one of several watersheds that drain into the Great Bay. As water travels across lawns, farm fields, roads, and parking lots, it picks up pollutants, referred to as non-point source pollution. The way we use our land has a dramatic impact on the quality of our water in the watershed.

Confidentiality! Responses to the questions will not be associated with names or addresses. You have been chosen for this survey because the Lamprey River, or one of its tributaries, is in your town.

Thank you for participating in the survey. Its purpose is to help land use planners and water resource managers design programs and policies that reflect what residents are thinking about in their communities. The main focus is on issues related to water quality.

What is your main source of water at home, and do you filter or soften your water?

Check all that apply:

- A private well on my property
- A shared well with two or more households/buildings in a subdivision
- A public (town/city) water system
- Purchase bottled water
- Home water filtering system
- Home water softening system

How is waste water disposed of at your home? Check all that apply:

- A septic system, which is _____ years old, and cleaned every _____ months.
- A shared sewer system with two or more households/buildings in a subdivision
- The public (town/city) sewer system

In general, have you thought about water pollution as a problem in these following locations?

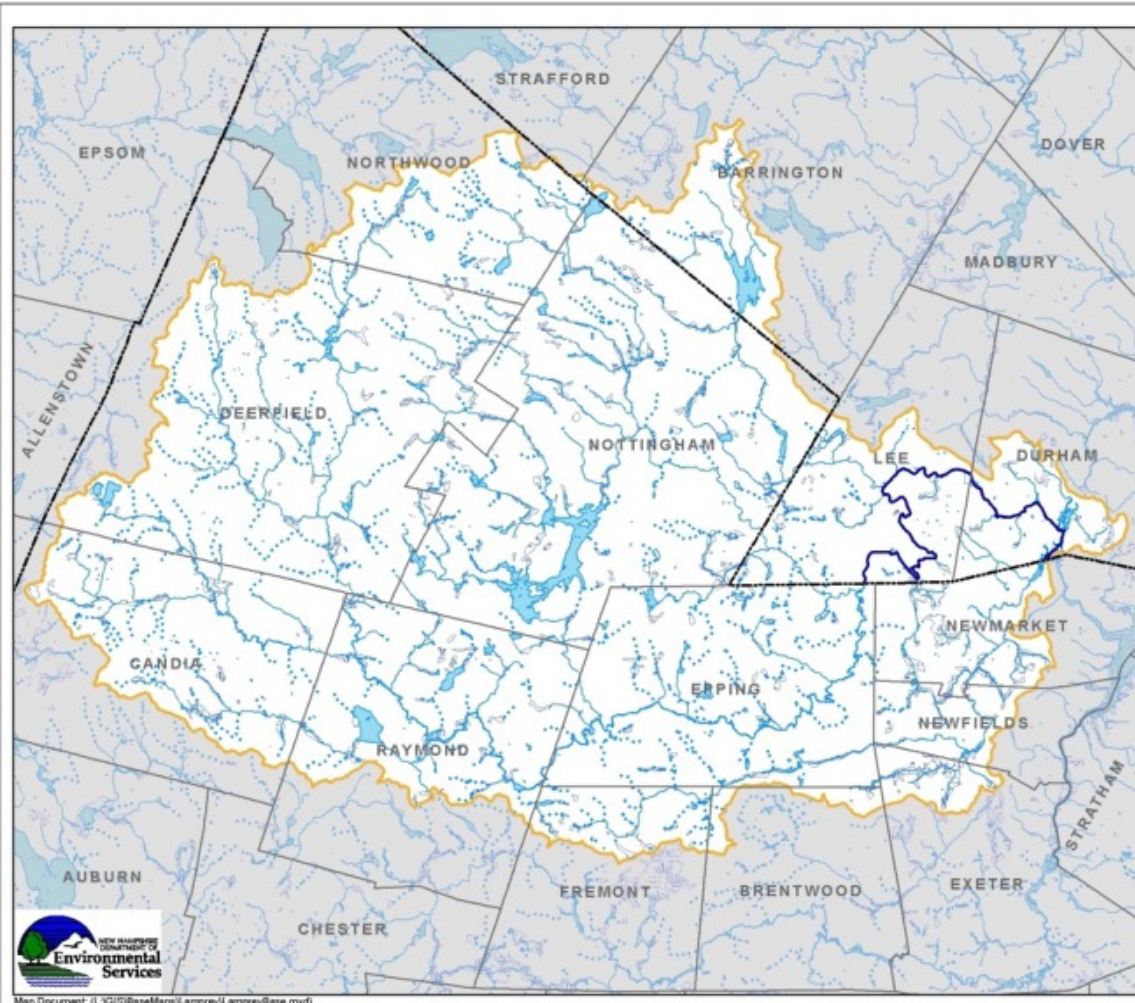
Location:	Yes, it is a problem in...	No, it is not a problem in...	I don't know if it is a problem in...
The United States			
New England			
New Hampshire			
Your county			
The Great Bay			

Your community			
Your household			
Lamprey River and Tributaries	Not familiar	Familiar	Very familiar
Lamprey River			
Little River			
North Branch River			
Bean River			
Picassic River			
Your drinking water			

How familiar are you with the location of the Lamprey River and its main tributaries?

Here is a map of the Lamprey River Watershed area. Please circle areas on the map where you feel like you know the area very well:

Lamprey River Watershed



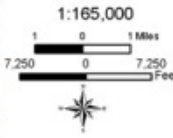
Legend

- County boundary
- Town boundary
- Lamprey Designated River Portion
- Lamprey River Watershed

Hydrography

- River, stream
- Intermittent stream
- Lake, pond
- Marsh, wetland

The coverages presented are under constant revision as new sites or facilities are added. They may not contain all of the potential or existing sites or facilities. NHDES is not responsible for the use or interpretation of this information. Not intended for legal purposes.



Map Document: (L:\GIS\Bases\Maps\Lamprey\LampreyBase.mxd)
7/26/2005 - 8:49:40 AM

These are problems that can exist in a community.

Community Problem	No, this is not a problem here	I Don't Know How I Feel About This	I am Somewhat Concerned	I am Concerned	I am Extremely Concerned
School at capacity					
High property taxes					
Loss of open lands to construction					
Lack of local jobs					
Availability of affordable housing					
Population growth					
Rising energy costs					
Lack of recreation opportunities					
Land pollution					
Traffic congestion					
Lack of sense of community					
Air pollution					
Lack of safe walking or biking paths					
Access to water for recreation					
Water pollution					
Garbage/refuse management					
Poor condition of roadways					
Town running out of water					
How the town/city looks					
Privacy at your home					
How your neighborhood looks					
Lack of public transportation					
Lack of businesses in town					
Lack of skilled community leaders					
Lack of long-range planning					
Lack of quality education					
Crime and vandalism in town					
Long commutes to work or shopping					

Is this a problem in your community? If so, how concerned are you?

Two major contributors to non-point source pollution are stormwater and septic system failure. **Stormwater** runs over land and paved areas (such as roads) and picks up pollutants (fertilizers, road salt, sand, automobile fluids, bacteria, and metals – to name a few!) Many storm drains discharge directly to surface waters without going to a waste water treatment facility. **Septic system failures** can also lead to pollutants seeping into waterways. These systems may go for years without notice that there is a problem. Improving these systems will cost money.

Who do you think should have the most, and who should have the least responsibility in paying for improvements to storm water management and septic systems in your town? Please rank the following from 1 to 5 to show who you think should have the most cost responsibility (#1) to who should have the least cost responsibility (#5), and those in-between (#2, #3, and #4).

	Rank (1-5) the Cost Share for Stormwater management	Rank (1-5) the Cost Share for Septic system management
Property owner	_____	_____
Town/City	_____	_____
County/Region	_____	_____
State	_____	_____
Federal	_____	_____

**What would you be willing to do to improve water quality in your community?
Check all that apply:**

- Pay higher taxes
- Volunteer on a local board to help make these decisions
- Support local government to purchase land for conservation
- Support rules about regular septic system management
- Support controls for building permits in town
- Support infill development for density in some areas in order to preserve other areas
- Attend meetings with neighbors
- Host meetings with neighbors
- Attend planning board meetings
- Volunteer to do water quality sampling
- Support expenditures for the preparation of long-range planning
- Support expenditures to implement projects to protect water quality
- Join a local water conservation group
- Support controls on water usage
- Use rain water for watering lawns and plants
- Eliminate the use of fertilizers and pesticides

Various household and recreation activities are listed in these two tables. Please indicate how often you participate in these activities:

Household Activities	Never	Seldom	Often	Does Not Apply
Use salt on driveway or walks in the winter				
Apply lawn chemicals/fertilizer				
Apply garden pesticides				
Water your lawn				
Water your garden/flower beds				
Change car oil at home				
Use low phosphate detergents				
Wash your car at home				
Put dog poop in garbage bags or toilet				
Catch rain water to use around the house				
Use low-flow shower head				
Use low-flow toilets				
Check the septic system				
Remove trees and shrubs near the septic system				
Pump out septic tank				
Participated in household hazardous waste day				
Send in water samples for testing				
Compost kitchen scraps				
Recycle cans, glass, or paper				
Use environmentally- friendly household cleaning products				

Natural Resource Recreation Activities	Never	Seldom	Often	Does Not Apply
Sail, canoe, or kayak in New Hampshire				
Boat on the Lamprey River or its tributaries (North River, Little River, Bean River, Picassic River)				
Watch wildlife (bird or nature watch)				
Go shell fishing in New Hampshire				
Fish in local water bodies				
Take walks or bike rides in town				
Enjoy the outdoors				
Hike in the woods or mountains in the state				
Swim in a lake or river				
Swim in the Lamprey River or its tributaries				
Use a motor boat in New Hampshire				

How much do you think the following potential sources of pollution contribute to a water pollution problem in your watershed?

Possible Pollution Source	Does Not Contribute	Contributes Slightly	Contributes Medium	Contributes Strongly
Roads				
Litter				
Home lawns and gardens				
Dog poop				
Home septic systems				
Agriculture runoff				
Gas stations				
Illegal dumping				
Air conditioning				
Automobiles and trucks				
Construction activities				
Industry				
Burning fuel for heat				
Businesses				
Waste water treatment facilities				
Livestock waste				
Landfills/garbage				
Florescent light bulbs				
Prescription drugs				
Cigarette butts				

Are there certain pollutants that you are concerned about?
 NO **YES**

List pollutants here and explain why you are concerned?

Community Attachment

What gives you a sense of belonging to your community? Check all that apply?

- Friends
- People in the neighborhood
- Living here
- Place of worship
- Owning property in the town
- People at work
- The schools
- Activities in the town
- Family
- People that work for the town
- The community volunteers
- The landscape
- Opportunities to get involved
- Other: _____

If local officials asked everyone to conserve water or electricity because of some emergency, how likely is it that people in your community would cooperate?

Not Very Likely to Cooperate	Likely to Cooperate	Very Likely to Cooperate	Don't Know
_____	_____	_____	_____

Overall, how would you rate your community as a place to live?

Excellent _____ Good _____ Only Fair _____ Poor _____

Do you expect to be living in this town in 5 years?

Yes _____ No _____ Don't Know _____

Where would you prefer to be living? _____ and why?

Keeping in mind that a lawn can be work (mowing, etc.), and you pay higher property taxes with more land, which of the following would you prefer:

½ acre lot _____ 1 acre lot _____ 2 acre lot _____ Larger than 2 acre lot _____

Which of the following would you prefer to have in your town? Check all that apply:

Farmland Sidewalks Affordable housing Parks
 Downtown businesses Public transportation My workplace

Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?

People can be trusted
 You can't be too careful
 Depends
 Don't know

Generally speaking, how much do you trust different groups of people?

Groups of People	Trust them a lot	Trust them some	Trust them only a little	Don't trust them at all	Does not apply	Don't know
------------------	------------------	-----------------	--------------------------	-------------------------	----------------	------------

People in your neighborhood

People in your community

People at work

Local news media

School administrators

Government employees

Local government officials

Places of worship

U. S. Government officials

Corporate America

State Government officials

Overall, how much impact do you think people like you can have in making your community a better place to live?

___ No impact at all. ___ A small impact. ___ A moderate impact. ___ A big impact

How many days in the past week did you read a newspaper? ___ days per week.

How many hours a day do you spend watching television on an average weekday, that is Monday through Friday? _____ hours per day.

How many hours do you spend using the Internet or email in a typical week, not counting the times you do so for work? _____ hours per week.

How interested are you in politics and national affairs?

Very interested	Somewhat interested	Only slightly interested	Not at all interested	Don't know
_____	_____	_____	_____	_____

Are you currently registered to vote? _____ Yes _____ No _____ Don't Know

As you may know, around half the public does not vote in presidential elections. How about you – did you vote in the last presidential election, 2004, between George W. Bush and John Kerry?

___ I did vote ___ No, I skipped that one ___ I don't vote ___ I don't know

How much of the time do you think you can trust the government to do what is right?

	Just about always	Most of the time	Only some of the time	Hardly ever	Don't know
Local government					
County/regional government					
State government					
National government					

Which of the following things have you done in the past twelve months?

Check all that apply:

- Signed a petition
- Attended a political meeting or rally
- Worked on a community project
- Participated in any demonstrations, protests, boycotts, or marches
- Donated blood
- Volunteered for a non-profit organization

Please check the activities that you participate in every week:

- Attend religious services
- Sports club or league
- Outdoor activity club
- A youth organization
- A parents' association
- A veteran's group
- A neighborhood association
- Clubs or organizations for senior citizens
- A charity or service group
- A labor union
- A professional, trade, farm or business association
- Ethnic or nationality group
- Civil rights or peace group
- Political group
- A literary or art group
- A hobby group
- A self-help or support group
- An group that meets through the Internet

Did any of the groups that you are involved with take any local action for social or political reform in the past 12 months? ____ Yes ____ No ____ Don't know

In the past twelve months, have you served as an officer or served on a committee of any local club or organization? ____ Yes ____ No ____ Don't know

Overall, how much impact do you think people like you can have in improving water quality?

____ No impact at all. ____ A small impact. ____ A moderate impact. ____ A big impact

public place

Recreated with friends or family in the outdoors

Participated in on-line discussion over the Internet

Attended a meeting about town or school issues

Volunteered for a community function

How many times in the past 12 months did you do the following?

Obstacles to Participation

Many obstacles keep people from becoming involved with their community. Thinking about your own life, are there obstacles or barriers that make it difficult for you to be as involved with your community as you would like, or not?

Obstacle?	Very important obstacle	Somewhat important obstacle	Not an important obstacle	Don't know
An inflexible or demanding work schedule				
Lack of childcare				
Lack of transportation				
Feeling unwelcome				
Concerns for your safety				
Lack of information				
Feeling that you can't make a difference				
Not knowing how to get involved				
Afraid that it will be more work				
Potential conflicts with people				
Feeling it would be a waste of time				

How likely is it that you will be involved in some community related activity in the next year?

___ **Very Likely** ___ **Likely** ___ **Not Very Likely** ___ **Don't Know**

A number of potential sources of information are listed below. Please indicate how much information on water-related or land use issues you have gotten from these sources:

Sources of Information:	I use this frequently.	I use this sometimes.	I don't use this at all.	This is not available to me.
Newspapers or magazines				
Attending meetings				
Government publications				
Neighbors				
Public officials				
Annual town meeting				
The community master plan				
Local public hearings				
UNH Cooperative Extension				
Through my work				
Environmental groups				
Retail stores				
Community newsletter				
Radio				
Television				
Internet sites				
Other:				

How would you prefer to get information on town related issues?

About Your Health: This gives us some ideas about the overall health of the community.

How would you describe your overall state of health these days?

Excellent Very good Good Fair Poor

Do you go to the doctor for regular check-ups? Yes No

How often do you wear a seatbelt?

All of the time Most of the time Some of the time

Never Does not apply

Do you participate in the following activities? Please check if you never do this, if you do this daily, OR put in the number of days in the week that you do participate in this activity:

I exercise at least 30 minutes... Never Daily OR Times a week

I eat out at a restaurant... Never Daily OR Times a week

I buy/eat organic food... Never Daily OR Times a week

I buy/eat fresh fruit and vegetables Never Daily OR Times a week

I drink bottled water... Never Daily OR Times a week

I drink tap water... Never Daily OR Times a week

I smoke cigarettes... Never Daily OR Times a week

I sleep very well... Never Daily OR Times a week

I drink alcohol beverages... Never Daily OR Times a week

I have dinner around a table with family and friends... Never Daily OR Times a week

Please list as many as five things that you believe threaten your, or your family's, health:

- 1.
- 2.
- 3.
- 4.
- 5.

Please tell us a little more about you: This will help us better understand what the different groups of people within the community think about these issues.

Are you? Male _____ Female _____
What year were you born? _____

Do you rent, or own this place? Rent _____ Own _____
If you own: How much do you pay in property taxes annually \$ _____
If you own: What is the approximate property value \$ _____

How many years have you lived in this town? _____

Do you consider yourself politically as a _____ **Liberal** _____ **Moderate-Liberal**
_____ **Moderate** _____ **Moderate-Conservative** _____ **Conservative?**

Please check the box that comes closest to your total family income before taxes:

_____ Less than \$20,000 _____ \$20,000 - \$40,000 _____ \$41,000 - \$60,000
_____ \$61,000 to \$80,000 _____ \$81,000 to \$100,000
_____ between 101,000 and 300,000 _____ over \$301,000

What is your highest level of education?

_____ High school _____ Some college
_____ Completed 2 year college _____ Completed 4 year college
_____ Masters _____ Ph.D. _____ J.D. _____ M.D.
_____ Other: _____

What is your current employment status? _____ Employed _____ Unemployed
_____ Retired _____ Other: _____

How many hours a week do you work for pay?

_____ per week _____ Does not apply

If you work outside the home: Do you ever telecommute - that is spend a whole day or more per week working at home instead of going to your main place of work?

_____ No _____ Yes _____ Does not apply

If YES: In a typical 5 day work week, how many days do you normally work at home?

_____ Less than once a week _____ 1 day _____ 2 days _____ 3 days _____ 4 days
_____ 5 days

How many **miles** do you travel to work and home again each day? _____ a day.

How much **time** does this work commute take you? _____ a day.

Have you recreated on or near open water in your community or a neighboring town in the past year? _____ Yes _____ No

How many people live in this household? _____

How many are children under 18 years old? _____

Do you have access to the Internet in your home? _____ Yes _____ No

How many different telephone numbers does your household have, not counting those dedicated to a fax machine or computer? _____

Have you or any member of your family seen any of the following materials regarding the Lamprey River Watershed? Please check the appropriate box.

NO, I have not seen this.	I saw something similar to this.	YES, I have seen this.
--	---	------------------------------------

A book, *The Story of Little Bear* by David Allan and Leslie Hamilton.

Lamprey River Curriculum. Standard environmental curriculum for elementary schools with extensions to high school.

A Video - *A River Story: The Lamprey Through History*, with an emphasis on the human history of the river. 20 minutes long.

"The Lamprey River, A Special Place." A pamphlet that includes a map, river conservation information and policies, and introduces the Lamprey River Advisory Committee.

"Living on the Lamprey." A pamphlet prepared especially for landowners along the river with information about the Lamprey's history, vegetation, and what landowners can do to conserve and protect the river.

A presentation about the Lamprey River Watershed.

The Lamprey river Wild and Scenic Management Plan

The Lamprey River Watershed Guide

The Importance of Streamside Buffers

Riverwatch: A Handbook for Water Quality Monitoring

The Lamprey River Resource Assessment

One last question!

There have been discussions in many towns about changing land use regulations to require buildings to be built closer together in order to reduce costs of materials for roads and utilities and to also preserve larger tracts of land for open space. **Do you see any other advantages to this type of development idea? Are you aware of any disadvantages to this type of development? Please write your comments here:**



Congratulations and thank you for completing the survey. For a summary report, please contact Mary Robertson at mary.robertson@unh.edu, or 312 James Hall, Durham, NH 03824. You will be contacted when the report has been completed.
Enjoy the rest of your summer!