1. Introduction

Household hazardous waste (HHW) is defined by the US Environmental Protection Agency as any products that contain ingredients found to be corrosive, toxic, ignitable or reactive (EPA 2012). Examples of such products include, but are not limited to pesticides, paints, bleaches, light bulbs, fuel, motor oil, medications, and lithium batteries. Because of its uniquely toxic properties, HHW requires special care upon disposal. Improper disposal methods include pouring liquids down household drains, dumping products on the ground, into storm sewers, or throwing them directly into the municipal trash system. Failure to dispose of these items properly can lead to incredibly damaging and unpredictable consequences to both human health and the environment. Though researchers estimate that 1% of the solid waste stream consists of HHW, this small percentage translates to 1.96 million tons of improperly disposed of HHW in 1990 and 2.16 million tons in 2000 (Sulzberg, et. al. 1997). Once in landfills, these items can continue to leach into surface water and groundwater, contaminating fresh water supplies. One gallon of improperly disposed motor oil has the potential to pollute up to one million gallons of water, posing serious threats to cogala2 (c) 0.2 (e) 0.2y85 -0.2 (t) 0.2 (hre) 0.2 (a)31h85 -0.2 (i) 0.2 (of) -0.5 (..2 .F

Improper disposal of HHW also has the potential to affect human health. Though HHW comprises 1% of the solid waste stream, this percentage does not account for HHW stored in the home or discarded through other improper means. The average U.S. household generates 20 pounds of HHW per year, resulting in as much as 100 pounds of accumulated HHW in the home during residence (EPA, 2013). If every resident of Saratoga Springs 25,000 population generated 4 pounds of HHW, the town would be responsible for 100,000 pounds of HHW. According to the 2011 Annual Report of the American Association of Poison Control Centers, of the most frequent 25 substances contributing to poisonings, HHW was involved in 14.37% of human poisonings (Bronstein, et. al, 2012). In addition, improper storage of HHW in the home can lead to indoor air pollution, as improper mixing of products can create dangerous gases or as homeowners fail to securely fasten the lid on wastes. HHW, alone or in combination with other substances, poses a threat not only to homeowners but also to waste collectors and landfill workers. Improper disposal of "HHW causes injuries to approximately 3% of waste collectors through explosion, acid or caustic splashes and burns from flammable substances" (Bapa 0.2 (t).,

however, reference the consequences of failing to dispose of HHW properly and accordingly lists HHW collection programs around the state (NYS DEC, 2014).

community. Many municipality temporary collection programs evolve into permanent programs over time due to the high cost of one-day events; however, many of these permanent programs stil service only 5-10% of a target population and operate on a stretched budget (Cabaniss, 2008).

Temporary HHW Collection Programs are collection "events" on designated days, in a designated place. Temporary collection programs also seem to be popular across the nation; 18 out of 25 HHW programs surveyed in Cascadia's (2005) study offered such programs. These events can either be stationary or mobile; mobile events are best suited to populations that are divided by large distances or heavy traffic and are best at gaining participation across the geographic area (Cabaniss, 2008). One-time collection events are best for areas with minimal or no access to county collection programs. Such temporary collection events are often conducted by outside contractors, which are expensive, but provide expertise and labor. However, municipalities often find one day collection events are prohibitively expensive and move their collection program to a permanent site; examples of municipalities moving from one-day events to permanent sites are detailed in the following case studies of New York state municipal programs.

Selective permanent collection programs collect only certain HHW in order to defray costs and possible dangers. Antifreeze, batteries, oil, and paint (ABOP) collection programs accept only the four categories that contribute the most to HHW and can be easily collected (Cabaniss, 2008). Special programs in the state of California hire contractors to handle the majority of HHW, but choose to handle other, less hazardous items themselves, such as used motor oil and cathode-ray tubes (EPA, 2007). The advantage of such programs is eliminating the costs of dealing with HHW with more expensive disposal rates. However, these programs limit

residential participation and leave out some of the more hazardous HHW, such as solvents, fuels, and pesticides.

A cooperative collection event is a coordinated collection effort among nearby towns or counties. These programs operate in the same way as temporary collection events, but under the control of multiple local governments; there is also the opportunity to create cooperative permanent facilities (EPA, 2007). Operating a cooperative collection program shares the costs among multiple bodies and can build upon already existing relationships between towns. However, this type of program assumes a high start-up cost, possible liability issues, and the need for staff training (EPA, 2007). Cooperation can also exist between multiple county agencies, such as the Department of Public Works and the Department of Public Health, or in a private-public partnership with a business interested in improving its environmental impact.

Collection programs run by a contractor or by hired staff are not necessarily considered a wholly separate type of program, but the difference in management types is important to look at. The presence of both contractors and locally hired staff occurs throughout the nation, often concurrently. In Cascadia's (2005) survey, all surveyed HHW collection programs used a combination of contractor and hired staff. Contractors provide broader knowledge and resources, can be more affordable (due to contractor bidding processes), assume responsibility in settling labor issues, and reduce liability and insurance costs for local governments. Hired staff provide increased customer service through direct personal contact, less expensive services, and increased flexibility.

Though HHW collection programs currently exist in all 50 states, the concept of HHW is still relatively new. Therefore, as this section shows, there are multiple methods for dealing with

HHW, some more effective than others. This section exhibits the current state of HHW collection programs, but is by no means exhaustive of new, innovative programs.

As within any academic debate, the most effective way to increase public participation for an environmental program is highly debated. Most of the research in this area is not even focused on HHW, but on municipal recycling programs. Some researchers believe targeting certain attitudes and traits based on behavioral psychology will create lasting change, while others disagree. Other researchers believe behavioral studies have been ineffective and only create short-term change and look to community organizing instead. In actuality, achieving increased public participation most likely results from a combination of all these theories or on a case-by-case basis.

One theory focusing on behavioral psychology is the Theory of Planned Behavior (TPB). This theory provides a framework for systematically investigating factors that influence behavioral choices, where intentions are influenced by attitude, the subjective norm, and perceived control (Tonglet et. al., 2004). Of the variables studied by Tonglet et al. (2004), pro-recycling attitudes were found to be the major deciding factor to recycling participation. These attitudes were influenced by having the appropriate facilities and knowledge in order to participate and as well as sufficient time or space. Other significant variables were previous experience and concern for their community's well-being (Tonglet et. al., 2004).

Keramitsoglou and Tsagarakis (2012) looked at the recycling behaviors of Didimoticho, Greece. They found that recycling participation is not necessarily due to variables associated with TPB but on personal traits, which are not necessarily incorporated into TPB models. They believe participation relies more on practical knowledge than on intrinsic motivations

(Keramitsoglou & Tasgarakis, 2012). Nevertheless, their findings were in line with TPB model projections, of positive recycling attitudes translating into participatio

Social Marketing looks directly at the barriers perceived or felt by people not directly participating in the program and assesses how to fix them.

An example of Community-Based Social Marketed was backyard composting program in Nova Scotia. New province regulations banned organic wastes from landfills and municipalities were charged with developing initiatives to meet these new regulations. Two counties decided to promote backyard composting (McKenzie-Mohr, 2000). Using Community-Based Social Marketing, the counties surveyed residents in order to find barriers and found that 56% of residents were already composting. Those who were not composting found it inconvenient,

participation. Researchers found that the opportunity to influence how things are decided

An educational campaign in Poland, based off of the U.K.'s 'Recycle Roadshow' program, trained advisors to visit households to conduct a short survey and provide people with educational materials. After this campaign, they saw an increase in participation and in the

Lower participation rates result in less funding, leading to a shorter window. The scheduling allows 23-25 participants every 20 minutes. The program annually services about 270 residents to a projected 375 participants, or 0.1-1.4% of the Saratoga Springs total population.The Department of Public Works provides traffic coordination for cars entering and exiting the site, while the department contracts out to a company specializing in HHW disposal, who is responsible for the unloading and handling of all items. The contracted party is also be responsible for all costs associated with mobilization, insurance, permitting, staffing, security, equipment, safety and contingency plans, waste handling, packaging of all acceptable materials, transportation, as well as HHW disposal. Materials Saratoga Springs currently accepts are listed in Table 1.

Items accepted in Saratoga Springs' Household Hazardous Waste collection program:	
liquid latex paint	Products containing mercury
Pesticides	Photography Chemicals
Corrosives	Compact Fluorescent Lamps/light bulbs and ballasts
pool chemicals driveway sealers	Fluorescent light tubes

reimbursement funding. (The DEC provides up to 50% in grants to help fund programs.) The city releases a bid for potential contractors for the event about every three years, with the last occurring in 2008 and the next projected bid to take place in 2015. In the past, the bid has been awarded to CARE Environmental Corp. and Maumee Express, Inc. (Department of Accounts, Saratoga Springs, 2013).

State. We will then seek to maximize economic and environmental benefits, as well as public knowledge and participation, through the enhancement of the current HHW collection program and increased education (adult and youth) and outreach efforts. Questions that guided our research are:

- How can we increase public knowledge and education surrounding household hazardous waste?
- What are the current successes and failures of HHW programs in other municipalities? And what alternative methods have they utilized to fund their program?
- What do the residents of Saratoga Springs wish to see in their city's program?
- What are potential short and long term goals that we can recommend for the Saratoga Springs program?

survey focused on overall knowledge of Saratoga Springs' HHW program, general HHW knowledge, and questions on best methods for program improvement. Information from the survey was analyzed and coded. Due to the high response rate for our survey, we are able to extrapolate our findings to the rest of the Saratoga Springs population with a 90% confidence interval.

We conducted five semi-structured interviews and two archival investigations with New York State municipal HHW collection programs at the city and county level. Although the Saratoga Springs HHW collection program is currently run at the city, rather than county, level, we decided to contact counties in order to examine the best practices of collection programs. Furthermore, after an initial overview of city programs operating either in close proximity to Saratoga Springs or in cities of similar size, it was discovered that the cities either completely lacked HHW programs or ran one day collection events, such as the one currently held in Saratoga Springs. Because of these factors, we decided to proceed with county programs in order to obtain the maximum amount of information on alternative practices and solutions for Saratoga Springs. Nevertheless, due to the disparity in resources between the city and county level, these programs cannot be compared perfectly.

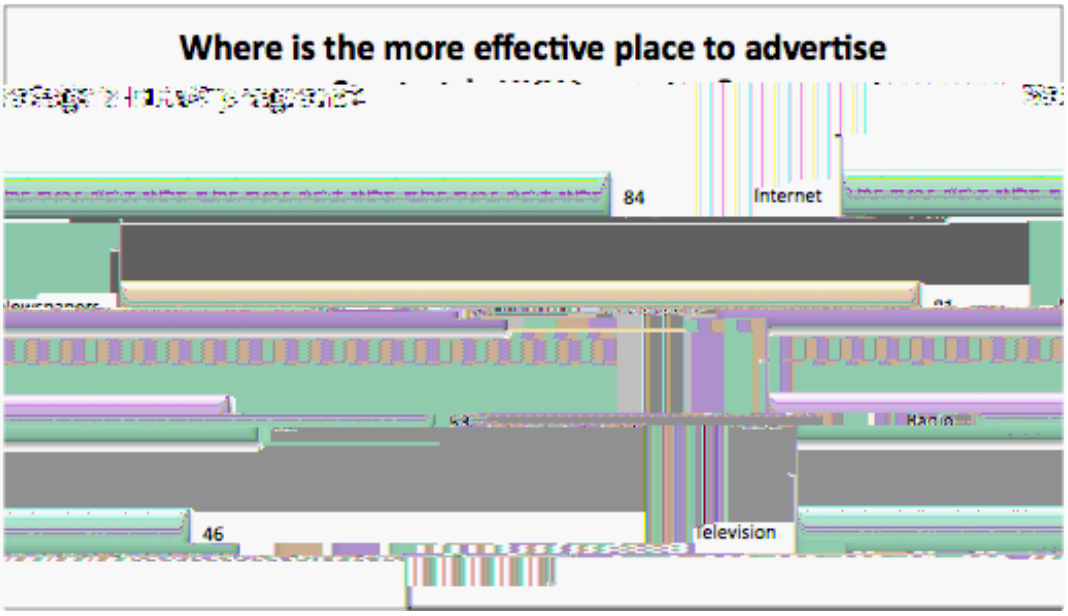
Municipalities were chosen based on having a well-established HHW program, receiving grant money through the DEC, and of similar relative size to Saratoga County (Table 2). During interviews (which lasted approximately 30-40 minutes), questions focused on the overall nature of the program, implementation costs, and method of advertisement. We also met regularly with our stakeholder contact within the Saratoga Springs Public Works Department to ensure best

representation of the city throughout the study and to take into consideration stakeholder needs and concerns as the research developed.

Response to: Have you ever heard of the Saratoga Springs HHW collection program?

This lack of knowledge about the program is most likely due to the fact that 84% (111/132) of respondents had never seen an advertisement for the program. Not only did respondents lack any knowledge about the program, respondents exhibited a lack of knowledge about HHW in general, as only 56.45% (70/124) felt confident in their ability to actually identify which household items constituted as HHW. These results point to major information channel discrepancies between the city and its residents concerning outreach and education.

increased advertising was the third noted solution with 62.1% (77/124) of respondents (Figure 2).



. Response to question: Where is the most effective place to advertise? Numbers at the end of the purple bar represent the number of residents who chose that answer.

In an open-ended question about the strengths and weaknesses of the program, the overwhelming conclusion was that nobody knows about the program. One respondent said “I've been waiting for YEARS to find a place to safely dispose of old paint that I inherited when I bought my house in 2007.” The 59.8% (79/132) of people said they knew so little about the program they could not give constructive feedback on the strengths and weaknesses. Respondents who were more familiar with the program cited the infrequency of the collections and inconsistency in time of year 20.5% (27/132), as major problems. Two respondents stated that even when there was a collection, there are not enough appointment slots. In terms of improving program weaknesses, 16.6% (22/132) of respondents thought greater advertising and outreach would build a stronger program. The listed strengths of the program were the benefits it does for the waste stream, and the fact that it exists at all.

The following archival data and semi-structured interviews allowed us to gain insight into the common barriers, challenges, and motives behind upgrading a HHW collection program. This data was gathered with the intention of aiding our stakeholder in the implementation of an improved HHW collection program.

Monroe County (2012 population: 744,344), upstate-New York's first HHW permanent facility, provides free services to all residents with an appointment, though it accepts out-of-county waste at a charge (Monroe, 2014). The county has also held scheduled collection days. Facilitated by the Department of Environmental Services, the program operates under a contracted waste disposal company (Monroe, 2014). Monroe County is exemplary for its online explanation and advertisement of their HHW collection program. The website clearly explains the consequences of improperly disposing of HHW, how to and where to dispose of it, proper packaging and handling of HHW, and a historical timeline of the HHW collection program's presence in the county (Monroe, 2014).

The HHW program of the city of Clifton Park (2012 population: 36,705) is relatively similar to that of Saratoga Springs. The city also holds special collection days. In order to participate, residents must register and submit a form identifying the waste that will be disposed of (Clifton Park, 2012). Nearby Malta, Ballston, and Halfmoon may also register for participation in this event. This collection event is well-attended by residents and is even quoted to be "just like hitting the easy button" (Griffith, 2013).

The counties of Oneida and Herkimer (2012 combined population: 298,375) have a joint facility to collect HHW. The facility, open 6 days a week all year, serves 8,000-9,000 residents yearly at no charge. Th

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monthly collection program in 2002. Residents pre-register for the events online and the facility services about 100 people at each event, for a total of 825 cars in 2013, or 0.5% of the county's total population. The program costs $80,000 a year, with half of the funds covered by DEC grants. Additionally, the County initially relied on contractors to meet the facility requirements; in the first bid contract, the County required the contractor to provide a storage shed, which would then become county property after the contractor's termination of service. The County advertises through newspaper ads, its website, its Facebook page, local organizations' newsletters, and would like to expand its advertising to radio, television spots, and billboards.

The facility is operated by a contracted company, along with a full-time employee from the county. The program has also developed a base of volunteers, and there are always at least two volunteers present at collection days for directing traffic. The facility charges residents $20 for a yearly permit to dispose of HHW. Jeff Edwards of Schenectady's Department of Economic Development and Planning explained that in a survey on the HHW program, many residents expressed complaints about the cost and waiting on crowded days, but that the majority of residents see the program as a benefit to the community (personal communication, 2014). According to Edwards, the County's philosophy is to only take what people cannot dispose of elsewhere in the community, such as batteries and CFLs at Home Depot and Lowe's.

The HHW collection program of Broome (2012 population: 200,600) and Tioga (2012 population: 52,337) Counties is conveniently located in the former maintenance garage at the local landfill; not only is the facility in a prominent and easily accessible location, but the garage doors at either end of the building allow for easy flow of traffic in and out of the facility. The program conducts three collections each month and uses a contractor for assistance at collections

After establishing how watersheds function, we moved on to discussing the different types of activities that occur in a watershed and how these activities could, in turn, affect the ecological system. Students brainstormed different human developments that were present in a watershed, each taking turns placing a representation of that entity into the model (for example, a barn to represent farming, a house for residential areas, a sand trap for golf courses, etc.). Students then sprinkled different colored powders around these entities to represent the pollution they created. The model was then sprayed down so that the kids could see how these pollutants entered the water supply. We next focused on finding a solution to this problem. Students shared ideas of ways that we could either minimize the amount of pollution or manipulate the landscape to prevent the pollution from entering the watershed. The students then tried out these ideas by implementing their solutions on the model, which was sprayed down again. By comparing the state of the water from the first run to the second, the club members were able to determine which strategies were successful and which weren't.

During the second session with the group, we elaborated on one of the solutions discussed during the watershed model activity. The students were asked to think of some of the items that they had around their house that might be harmful if they were to end up in the environment. Many of them listed items such as light bulbs and various household cleaners, most of which are indeed defined as household hazardous waste. We then introduced the kids to that morning's activity, which consisted of creating substitute household cleaners that were environmentally friendly and could replace the more harmful products found in their homes, thereby decreasing the possibility of pollution of the watershed.

The students were separated into three groups. Each group was presented with a recipe for an environmentally friendly household cleaner. Once the cleaners had been mixed, they were

distributed into different spray bottles and containers that the kids then labeled with their name, product name and recipe so that they could remake it in the future. The kids were also each given a reusable bag to take their products home, which contained a handout outlining the definition of

Many HHW collection programs throughout the nation also have materials reuse centers, where residents can exchange partially us

York and a statewide paint stewardship program would create about $25 million annually (PSI, 2014). California, Connecticut, Rhode Island, and Oregon have all implemented such programs.

Another approach has been to simply reduce the production of HHW through reducing the consumption of household hazardous products. Our main recommendation for the Saratoga Springs collection program is to enhance its outreach and education initiatives, which would increase awareness of not only the city's HHW collection program, but the benefits of avoiding household hazardous products in the first place. Though the Saratoga Springs program currently advertises and receives press coverage in the local newspapers, they do not utilize social media. The avenues of Facebook and Twitter proved helpful in distributing our surveys to the local community and revealed a lack of awareness in this audience of the HHW program and the definition of HHW. Such social media avenues have the potential to reach larger portions of the Saratoga Springs community and at a very low cost.

Providing additional informative material on the collection program and on HHW in

heard of the program were eager that it existed; a typical response to what is a strength of the program was “that it exists at all.” Increasing public awareness through outreach and education initiatives, as well as offering more HHW collection days, are possible ways to improve on what the Department of Public Works has already created. The city of Saratoga Springs currently provides a beneficial service to the local community; we hope that the program can expand its efforts to include more participants in the future. There has been talk of the city partnering with the county on its HHW collection program, which would bring this service to a larger population.

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Gifford, R., Nilsson, A. (2014) Personal and Social Factors that Influence Pro-Environmental

Appendix A

Survey

1. Have you ever heard of Saratoga Springs' household hazardous waste collection day?
   _____Yes
   _____No
   If yes, how did you hear about it?

2. What do you feel are the strengths and weaknesses of the current Household Hazardous Waste collection program?

3. Have you ever seen advertisements for the Household Hazardous Waste program?
   _____Yes
   _____No
   If yes, where?

4. Where do you think would be the most effective place to advertise the Saratoga Springs household Hazardous Waste program?
   _____On the internet
   _____Newspapers
   _____Radio public service announcements
   _____Television public service announcements and commercials
   _____Other (please specify)

5. Have you ever participated and submitted hazardous materials to Saratoga Springs' Household Hazardous Waste collection program?
   _____Yes
   _____No
   If yes, how many times have you participated?

Appendix B
White Paper

Saratoga Springs Household Hazardous Waste Collection Program - Survey Results and Suggestions

Survey Results

The Saratoga Springs' household hazardous waste collection program draws about 247 participants each year. Currently, the collection occurs roughly once a year at Weibel Ave and results in mainly the collection of paint materials, pesticides, and bulbs. In order to identify ways to increase residents' use of this event, we distributed surveys to uncover the public's perceived barriers to participation. A total of 132 surveys were collected. Of those surveyed, 73% reported having never heard about the collection program, and 84% replied that they had never seen it advertised. Only 22% claimed to have used the program before. In addition to a lack of advertising, another major barrier preventing disposal appears to be education: only 56% of respondents reported feeling confident in their ability to determine which items in their house constituted as household hazardous waste.

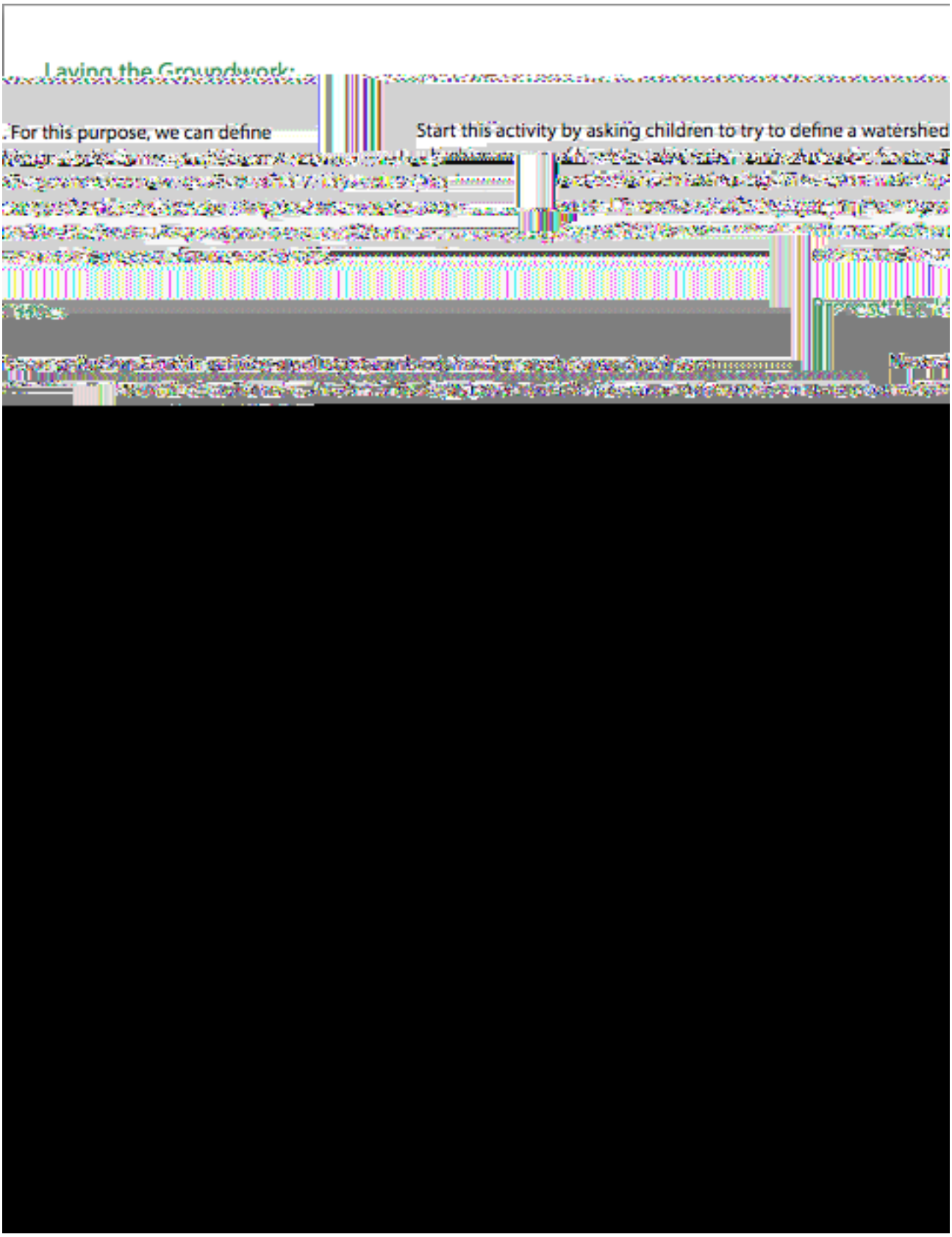
In response to how to increase participation, 78% of respondents preferred a more permanent site for the program, while 63% requested more general information, such as how to handle HHW and what qualifies as HHW. Further, 58% of respondents cited more frequent collection days as a solution to make HHW disposal easier. These findings, in addition to the main barriers to participation, reveal a desire for increasing the program's general existence whether through more collection events or a permanent site, and for increased advertising and outreach a

company with an incentive to ensure the safe disposal of HHW (i.e. a company that produces hazardous materials).

We also suggest the creation of a materials exchange program, where residents can turn in opened, but still usable, household products for other residents to use. Household products would instead be reused, rather than designated as waste. Additionally, since the collection program already collects mainly paints, pesticides, and bulbs, the Saratoga Springs program could collect only these main wastes. Conversely, the program could work with local hardware stores to increase their collections of paints and bulbs, diverting the bulk of the waste form the city's collection program.

Nevertheless, expanding the program is all with the hopes of increasing public participation. The survey results lead us to strongly suggest increasing the presence of the HHW collection program on the City of Saratoga Springs website, whether through a more accessible link on the site's first page or by providing multiple PDFs with educational material on the program and HHW in general. Further, our group discovered first-hand the power of social media, as the majority of our survey results came from outreach conducted on Twitter and Facebook. These sites are free of charge, and receive more foot traffic than the City of Saratoga Springs website, thereby increasing the chances of reaching the program's target population. Contacting local related groups, such as Sustainable Saratoga and Wilton Wildlife, to post on their walls may be one low cost, high impact way to increase participation in the program.

For further information on our project and findings, our final paper will be available to you, as well as attendance at our final presentation.


Laying the Groundwork:
. For this purpose, we can define
Start this activity by asking children to try to define a watershed