



Butte Environmental Council

Public Knowledge of Water Quality

Final Survey Results 2007

Education and Outreach Program

Impact Report

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EXECUTIVE SUMMARY

The Butte Environmental Council (BEC), as part of the Chico Urban Streams Alliance (Chico USA) conducted two *Public Knowledge of Water Quality Surveys* (2005 and 2007) and a 2006 *Education and Outreach Program* (EOP) designed to address urban run-off issues in Chico, CA (See Appendix I for Proposition 13 CALFED Watershed Protection Grant Program, Agreement between the State Water Resources Control Board and the City of Chico) This report provides an analysis of the 2005 and the 2007 survey data to determine what changes have occurred in the responses of the public regarding urban run-off issues. In addition, the analysis examines the 2007 survey questions designed as direct and indirect indicators of changes in respondent answers as a result of the EOP.

Analysis Results

The goal of the 2006 EOP was to develop awareness, increase knowledge, modify attitudes, and change behavior related to water quality issues in Chico, CA based on the results of a 2005 water quality needs assessment survey, and specifically targeting homeowners and potentially polluting businesses. Those results indicated that significant numbers of Chico residents (two-thirds of the population) were unaware that storm water is not treated by conventional treatment methods before entering local creeks and streams. As a result, BEC conducted a multifaceted multi-media public education and outreach campaign to increase knowledge and saliency about local urban run-off pollution issues. The EOP included electronic, broadcast, print, and public event media outreach activities. (See Appendix II for example EOP materials) The comparative results between 2005 and 2007 responses to the surveys, as well as in-depth analysis of the 2007 responses related to the EOP messages, suggest that the EOP was successful in changing attitudes, knowledge, behavior, and public awareness regarding local run-off pollution issues. In particular:

- ❖ Respondent behavior is consistent with values and activities promoted by the messages.
- ❖ More respondents self-identify as knowledgeable about run-off issues.
- ❖ Indicators of awareness suggest increased knowledge of pollutants targeted in messages.
- ❖ Reported behavioral changes are in the direction of the outreach messages.
- ❖ The EOP also created additional support for environmental protection.
- ❖ Increased willingness to pay a lump sum tax each year to protect water quality.
- ❖ Increased support for environmental advocacy and education organizations.

Recommendations

The results of the survey imply that the Chico USA 2006 EOP is responsible for developing awareness, improving water quality protection knowledge, modifying attitudes, and changes in behavior in types of respondents who already engage in water quality protection practices as well as those who indicated they did not do so prior to exposure to outreach messages. Future EOP efforts should continue to offer a multi-faceted, multi-media campaign designed to not only heighten the salience of run-off pollution issues, but to provide practical information and advice to the public. It is important that the terminology be made as clear as possible to reduce the ambiguity and complexity involved in run-off pollution issues. For example, lawn clippings and soil run-off are pollutants of local waterways; yet as organic matter present a complicated outreach message. In addition, future EOPs should provide low-cost options for privately as well as publicly adapting and addressing common sources of run-off pollution.

PURPOSE OF THE REPORT:

The purpose of the report is to compare direct and indirect indicators of impact and outcomes of the Butte Environmental Council (BEC) Chico Urban Streams Alliance (Chico USA) 2006 Education and Outreach Program (EOP) based on reported and observed differences in awareness, knowledge, attitudes, and behavior regarding urban run-off and best management practices (BMPs) for addressing water quality issues in Chico, CA. The analysis first examines differences between answers to a 2005 Public Knowledge of Water Quality Survey, designed as a needs assessment, to answers on the same questions in a 2007 Public Knowledge of Water Quality Survey. Second, the analysis examines the 2007 Survey questions designed as direct and indirect indicators of changes in respondent attitudes and behavior as a result of various activities in the EOP intended to develop awareness, improve knowledge, modify attitudes, and change behavior related to water quality issues. The results of the survey imply that the BEC Chico USA 2006 EOP is responsible for developing awareness, improving water quality protection knowledge, modifying attitudes, and change in behavior in types of respondents who already engage in water quality protection practices as well as those who indicated they did not do so prior to exposure to outreach materials.

GOALS OF EDUCATION AND OUTREACH PROGRAM

The goals of the 2006 EOP were to develop awareness, improve knowledge, modify attitudes, and change behavior in homeowners and potentially polluting businesses, related to water quality issues in Chico, CA. These goals were set based on the results of a 2005 water quality needs assessment survey conducted in Chico, CA from September 1, 2005 to September 30, 2005 (see Appendix III for 2005 Report and Executive Summary) and the model of the Sacramento Stormwater Clean Water Business Partnership Program. Specifically, the 2005 Chico USA, *Clean Creeks Project*, Urban Runoff Pollution Public Knowledge Survey results indicated that significant numbers of Chico residents (two-thirds of the population) were unaware that storm water is not treated by conventional treatment methods before entering local creeks and streams. To address this lack of awareness, BEC conducted a multifaceted multi-media public educational campaign to provide information about why it is important to reduce runoff pollution and how to prevent or avoid contributing to pollution in local creeks and streams.

Targets for the Public Education and Outreach Program

The results of the Chico USA public knowledge survey indicated that television, local newspapers, magazines, radio and the Internet are the Chico public's media preferences through which to receive information on local environmental issues and home maintenance. Only 10 to 15 percent of survey respondents indicated that they preferred to get information on local environmental issues and home maintenance from brochures. The audiences were targeted based on cross-tabulations of 2005 survey data. These data indicated that the best media sources through which to convey information included television, radio, billboards, newspaper ads, and Internet presentations. In particular, full-time employees (which make up nearly half of survey respondents) were targeted with television, radio and billboards. Retired, disabled, unemployed, and stay-at-home individuals were targeted in newspapers. Finally, students were targeted with Internet presentations. As a result, the EOP multi-media outreach campaign included the majority of outreach through television, the daily newspaper (articles, press releases and ads), radio public service announcements (PSAs), murals and storm drain markers, the Internet and dissemination of other promotional items. (See Appendix IV for Media Outreach Strategy.)

Expectations for Education and Outreach Activities

Each communication medium was designed to multi-task for best coverage and for providing both knowledge and heightening the saliency or awareness of different types of water quality issues. (See Appendix II for example EOP materials) For example, while the television commercials were primarily designed to provide tips for runoff pollution prevention best management practices, they contained an original, engaging musical score and positive images, to also create supportive attitudes. Posters and murals were designed with one simple, direct message to create awareness of runoff pollution issues, and also contained humorous, captivating images to simultaneously create supportive attitudes.

Knowledge and Awareness. The nature of radio and television media outreach only allows for seconds of exposure to the message, but the opportunities for repeated exposure over a concentrated period of time are beneficial to create awareness of a primary message. The Chico USA EOP employed this method with radio and television PSAs. Posters, murals, and placement of storm drain markers were designed to heighten awareness to runoff issues in dramatic, noticeable and memorable presentations. Newspaper articles and the Chico USA web pages were designed to provide greater access to knowledge about runoff issues and solutions. Newspaper and Internet media are self-directed sources and allow for sustained audience interaction. Learners can process educational messages over time, rather than in a few seconds as is the case with broadcast media, so that more complicated or in-depth information can be relayed. For example, a learner can begin reading an article, or web pages on the Internet, and return to it repeatedly to take in more information as needed, and/or use it as a reference source.

Supportive Attitudes. The murals, broadcast media, and public event program representations were designed to create supportive attitudes. The positive pitch and playful images of the murals create an open, receptive response from the public. People are able to process the importance of the message of runoff pollution prevention without a defensive or alienated response. The murals served as both a self-directed educational media source, and one that the public can experience by chance anonymously. The longevity of the murals makes them conducive to fostering public awareness of the pollution issue and creating a supportive attitude over time. The tone of the broadcast media products was playful, yet informative, and integrated engaging music and creative images that were designed to create supportive attitudes. The public interacted with the television and radio PSAs by random chance, and in a series of brief, repetitive experiences. Alternatively, having a personalized, self-selected, one-on-one exposure to a program representative at public events also facilitated development of a supportive public attitude towards the program message. The outreach program representative provided information at diverse public events and gave a “face” to the message.

Behavioral Change. Television ads, designed to lead to behavior changes, provided quick, easily understood pollution prevention tips. The give-away ancillary products, such as the brochures, Cal Water Inserts, magnets and buttons were designed to motivate behavioral changes for best management practices. These products provided in-depth information that could be referred to easily in a visible space at home or work. They were designed with either a specific behavior change message, such as the “*Smart Butts Use Ashtrays, Not Waterways*” buttons, or served as a reference tool for home maintenance, auto maintenance, and lawn and garden care best practices. The storm drain markers were placed strategically to prevent the public from dumping pollutants into gutters and storm drains. The Chico USA web pages and newspaper articles provided detailed information on best management practices for home, automobile, lawn and garden care, and contact information for Clean Water Business Partners.

Message Content

The EOP content was designed with one overriding mission, and addressed 2005 Survey findings that the majority of the Chico public was unaware of their personal impact on the quality of the water in local creeks and streams through their household-generated urban runoff pollution. Just over one-fourth of respondents stated that they are not knowledgeable about local water issues, and over half of the respondents stated that they are only somewhat knowledgeable. The media campaign content was designed to educate the public about the contribution of automobile products, yard and garden chemicals, cigarette litter, pet waste, and soil and green waste to runoff pollution of local creeks and streams. One slogan, "*If it's in your gutter, it's in your creek,*" directly concentrated on sensitizing the Chico public to pollution from urban runoff. In addition, the content went beyond helping the public recognize the problem of such runoff; the content provided information on Best Management Practices for runoff pollution prevention. For example, messages included information about the importance of washing cars at a commercial car wash, or if at home, on the lawn. Or, alternatively, the messages encouraged hiring *Clean Water Business Partners* to clean their carpets and maintain their lawns and gardens to support business that employ Best Management Practices.

COMPARISON OF 2005 AND 2007 SURVEY RESULTS

BEC collected the data for each survey by conducting telephone surveys based on randomly selected landline telephone numbers purchased from Survey Sampling International (See Appendix V for combined survey questionnaire and codebook). The population of Chico, CA is characteristic of a small city with a large university as a dominant employer for the area. Its population has a high density of educated individuals and its social and political culture is sympathetic to conservation and "green" practices. California State University, Chico has on average 18,225 students, faculty, and staff [<http://www.csuchico.edu/pub/facts/>] and has been recognized as a "green" university with active recycling and sustainability programs promoting substantial community outreach.

Survey Similarities In Survey Population Demographics

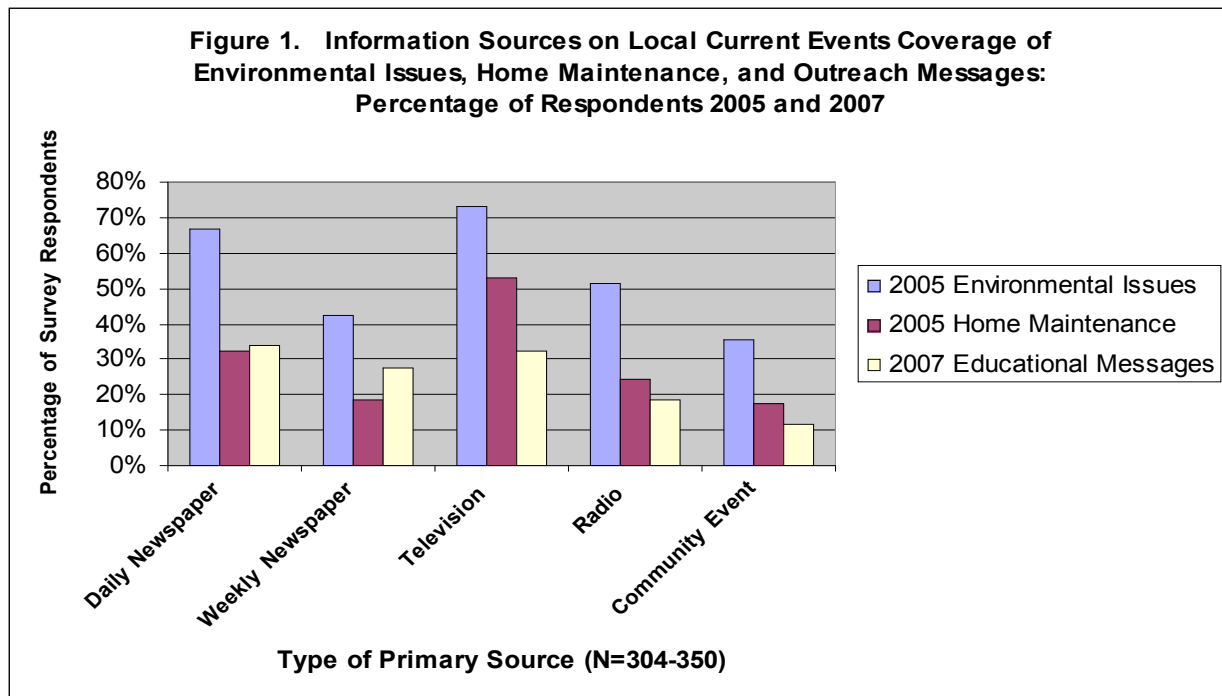
The data resulted in remarkably similar demographic distributions (see Appendix VI for details). In both 2005 (n=350) and 2007 (n=304), the distributions reflected a cross-section of the population of Chico, CA. Such similarities increase the validity of comparisons across the two surveys. In particular, both surveys yielded slightly more female respondents (2005 51.5%, 2007 56.9%) than male respondents. Both surveys were dominated by 40-59 years olds (over 35%), although the 2005 survey had slightly more 18-29 year olds than the 2007 survey. The population is highly educated in both surveys where over 26% had some college, over 25% had a BA or BS, and 20% had graduate level degrees.

Although each survey had about equal percentages of middle income respondents, the 2005 survey included more low income individuals (2005 38%, 2007 16%), and the 2007 survey included more high income \$75,000-\$99,999 respondents (2005 9%, 2007 15%). There is also a disparity reflected in the distribution of employment, where the percentage of respondents not in the workforce (unemployed, stay home, retired, or disabled) are about the same in both surveys, but the 2007 survey has fewer students (2005 9%, 2007 3%) and more fulltime/part time working respondents (2005 53%, 2007 65%) than the 2005 survey. Finally, both surveys are dominated by respondents who have lived in the area for over 16 years, although the 2005 survey had almost as many respondents who lived in the area 5 years or less (2005 31%, 2007 17%).

Question Differences in 2005 and 2007

Although most of the questions asked in the 2005 and 2007 surveys are the same, some questions in 2005 were deleted and replaced with questions designed to measure or indicate the extent to which the 2006 EOP achieved its goals. Questions in the 2005 survey about where respondents find information on local environmental issues (q31) and home maintenance (q32) were replaced in 2007 with questions about where outreach educational messages were seen or heard (q31) and whether the respondent was aware of the information before seeing or hearing these messages (q32). In the 2007 survey, respondents were also asked which behaviors they have changed to protect local creeks and streams from polluted water runoff (q33).

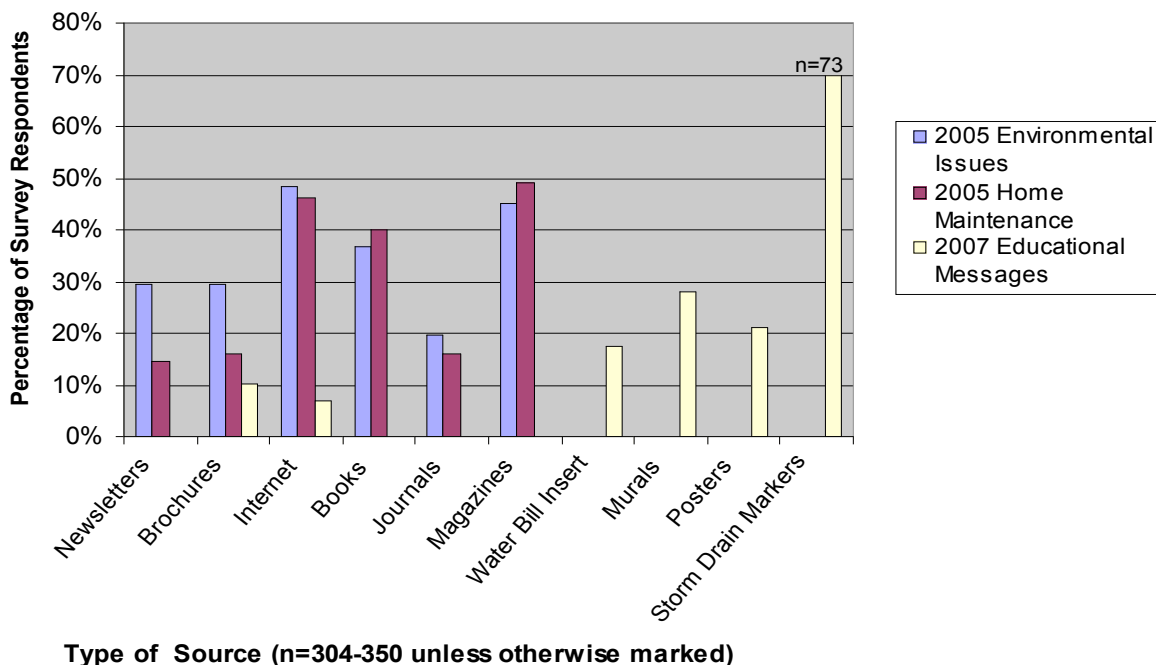
Current Event Sources. For this analysis, the information sources have been separated into *Current Events* sources and *Other* sources. As seen in the comparison in Figure 1, in 2005 respondents found most of their current event environmental issue and home maintenance information from newspapers and television.



In 2007, most of the educational messages were viewed in newspapers and television.

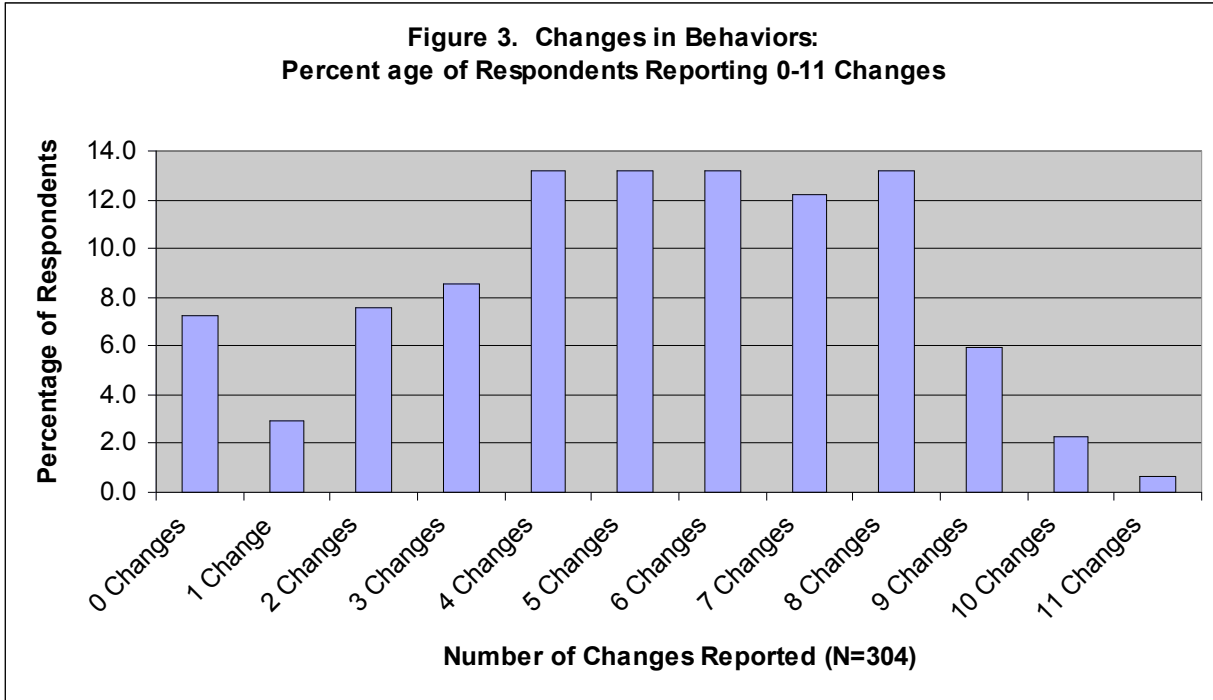
Other Types of Sources. For information accessed in other types of sources, in 2005 over 45% of respondents find information on the Internet or magazines, and more than 37% found the information in books. As seen in Figure 2, in 2007, only 7% saw the outreach messages on the Internet, yet 28% saw the murals and 21% saw the posters created for the outreach.

Figure 2: Other Information Sources on Environmental Issues, Home Maintenance, and Outreach Messages: Percentage of Respondents 2005 and 2007

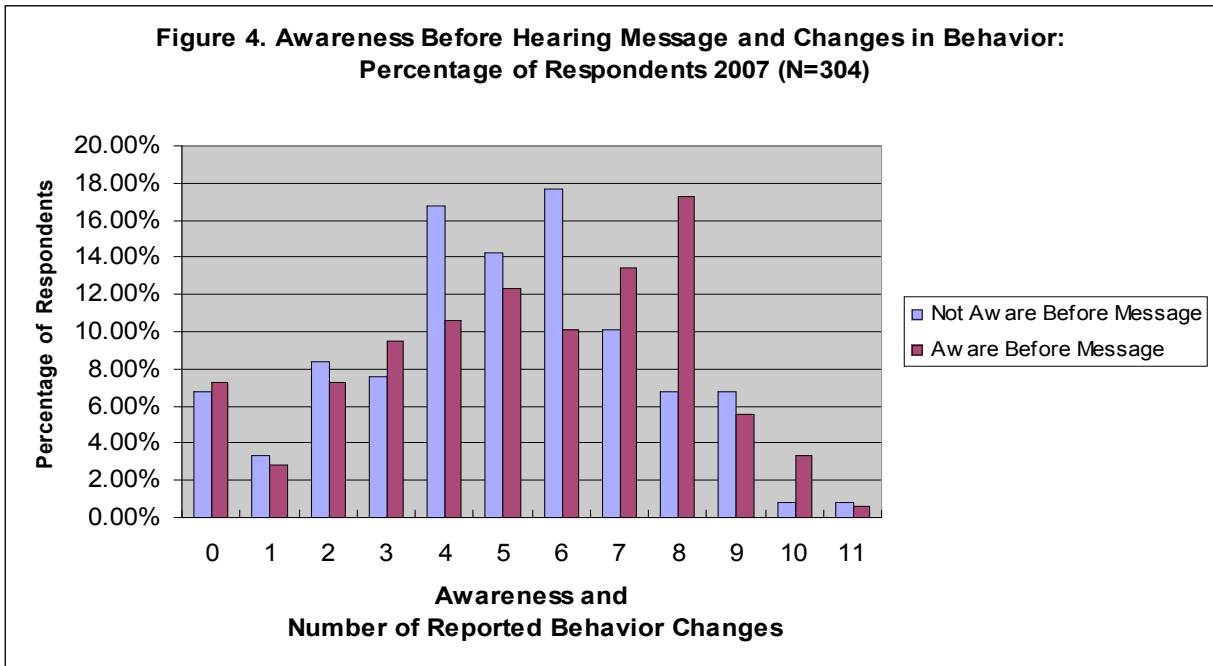


Due to an oversight in the survey, respondents were not asked about the storm drain marker campaign, yet of those respondents who volunteered other sources of these educational messages, 70% mentioned the storm drain markers.

Awareness Before Outreach Message and Behavioral Change. In 2007, respondents were asked if they were aware of the issues before they heard or saw the outreach messages (q32) and 40% said they were not aware of the issues. Following that question, respondents were then asked which behaviors they have changed that were listed in the questionnaire (q33). These changes include washing the car on the lawn, recycling oil, not over fertilizing the lawn, picking up pet waste, using ashtrays, using reusable shopping bags, never littering, using Clean Water Business Partners, using environmentally-friendly products, and other changes not listed. Figure 3 shows that while some respondents (7.2%) report no change (which could mean either they already engaged in best management practices and did not change, or that they did not change their behavior to match anything from the list), most of the respondents made from 4 to 8 of the listed changes.



Due to an oversight in the survey, the question did not link the outreach message to the changes nor did it specify the time frame for the changes. Yet, as Figure 4 suggests, 7 of the 11 groups of respondents who were not aware of the issues prior to the outreach messages are a greater percentage of each category of respondents who reported making changes.

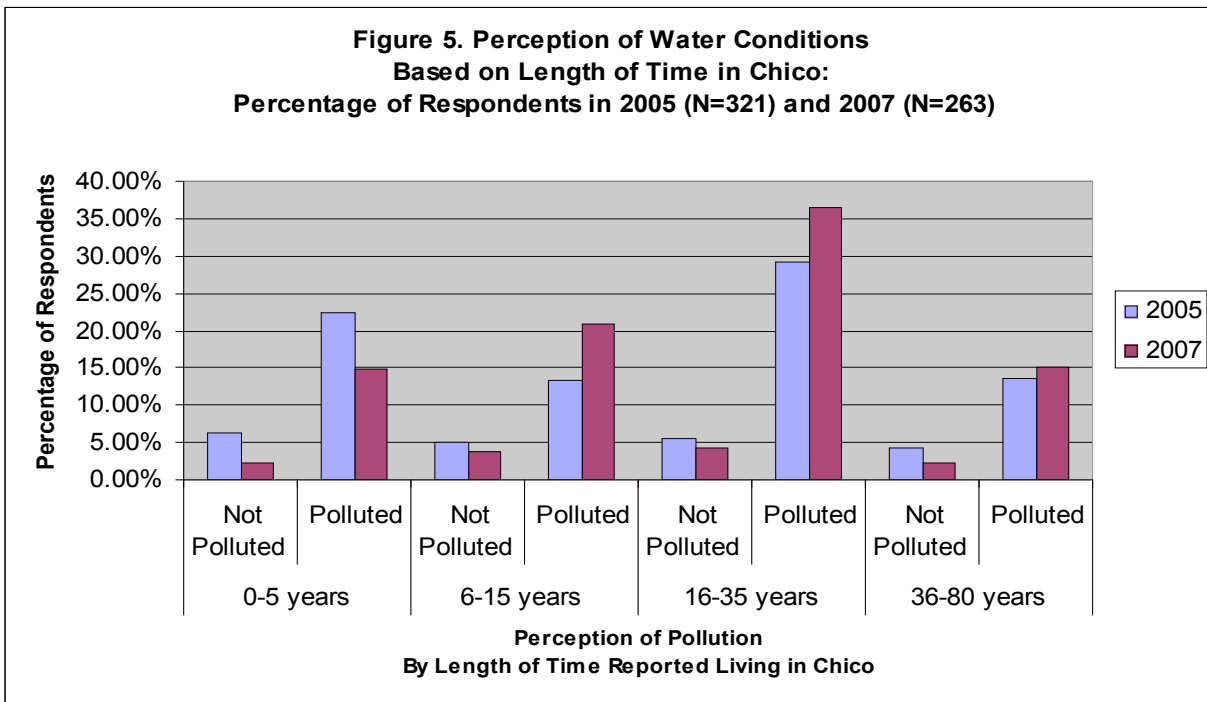


In particular, those who were unaware comprise a much larger percentage of those respondents who made 4 to 6 of the changes. This suggests that q33 is a reasonable indicator of behavior change related to the outreach messages and that outreach messages could be responsible for positive changes in environmentally responsible behavior.

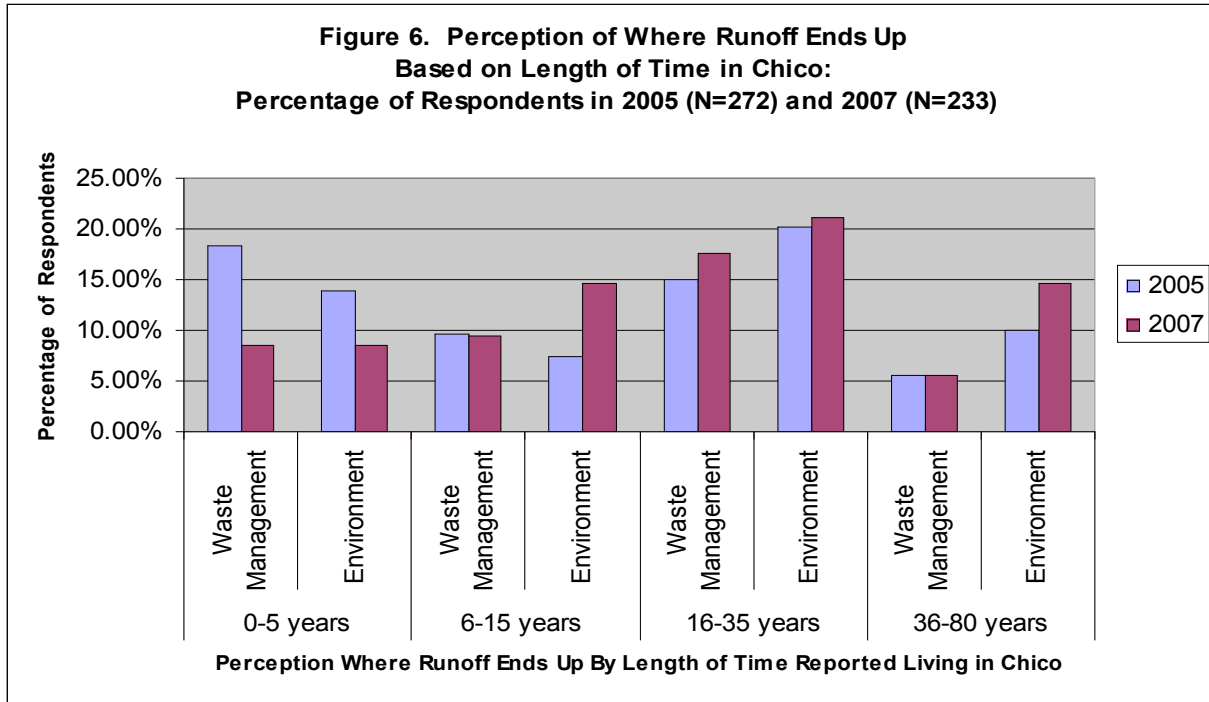
Public Awareness of Water Quality Issues

How much does the Chico public think it knows generally about local water issues and conditions? There are two sets of questions that are designed to identify what respondents know about water conditions and soil runoff in Chico. Given that education and length of time living in Chico influence perceptions of water issues, data about perceptions of pollution, runoff, and water issues were controlled by data on either educational attainment or length of residency.

Perception of Water Conditions. Respondents were asked their opinions about the conditions of Chico creeks and streams (q1) and where they believe residential runoff ends up (q16). The question responses were recoded to simplify the presentation of the data and a cross-tab created between each question and the respondent’s length of residency. Figure 5 shows that relationship between length of residency and perception of pollution is different between long time and short time residents in both 2005 and 2007.

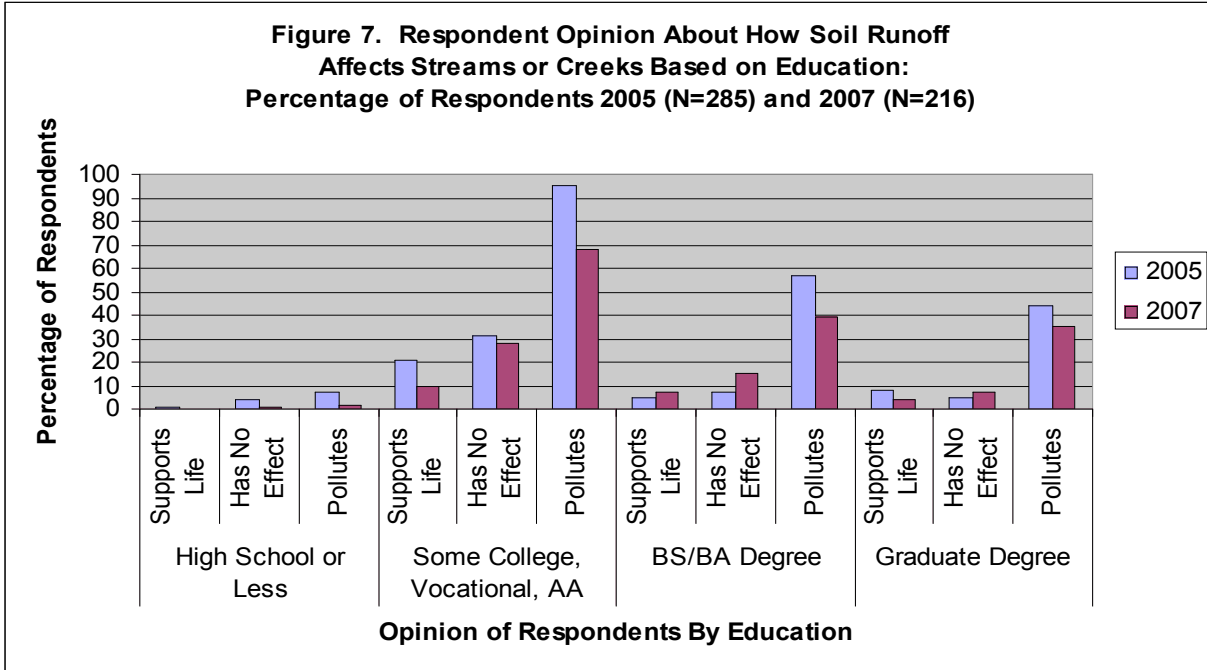


There are, however, a greater percentage of long time resident respondents who perceive the creeks and streams as being polluted in 2007 than in 2005. This is true for each category from 6 years or more. As Figure 6 illustrates as well, there is a disparity between perceptions about what happens to residential runoff.

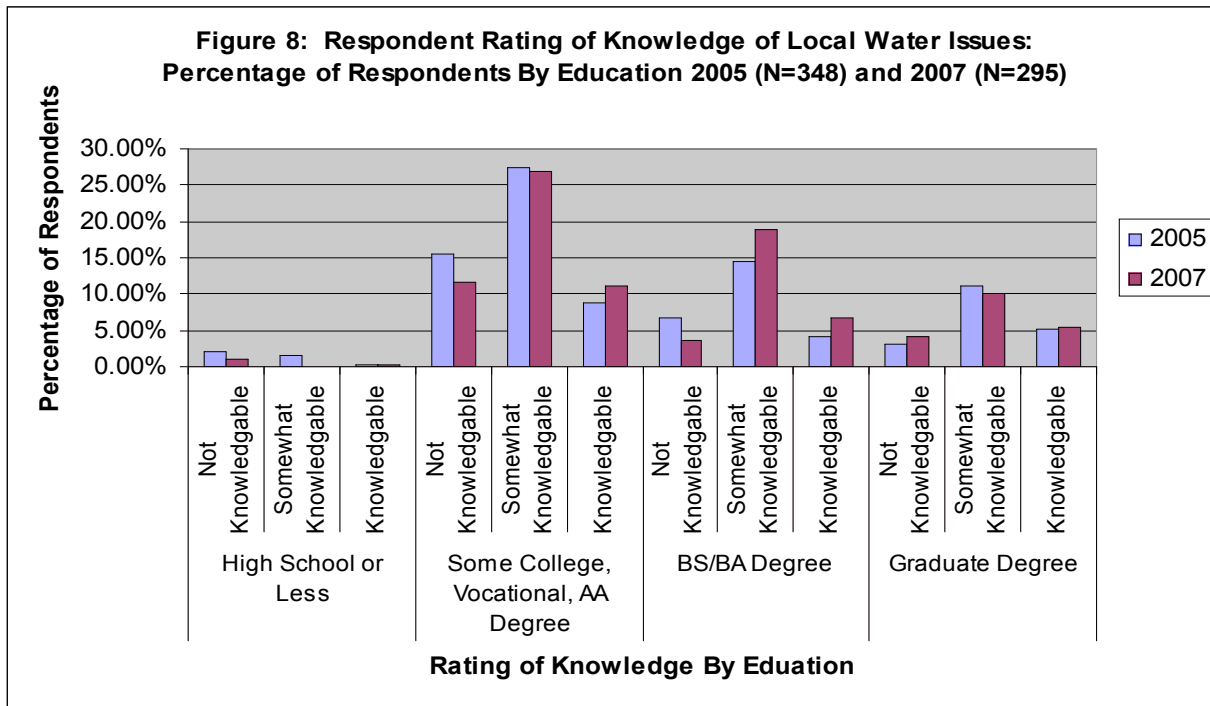


As shown in Figure 6, a greater percentage of the 2007 respondents who have been residents from 6-15 years recognize that the runoff ends up in the environment than those in 2005. Short time residents' opinions are clearly different from long time residents regarding where runoff ends up.

Perceptions of Own Knowledge. Respondents were asked their opinions about how soil runoff affects streams or creeks (q28) and to rate their knowledge of local water issues (q30). The soil runoff question is a narrow and difficult condition to understand because unlike other runoff waste like fertilizer or detergents, it is not obvious how soil runoff may create water pollution. Little or no attention was given to this issue in the outreach messages. Alternatively, asking respondents how they rate their own knowledge provides an indicator of how confident the respondent may be in answering questions about water issues broadly defined. Such broad and more obvious water issues were addressed directly by the outreach messages. For the data analysis, the question responses were recoded to simplify the presentation of the data and a cross-tab created between each question and the respondent's reported level of educational attainment. Figure 7 shows that a relationship between educational level and understanding of complex water issue like soil runoff.



Clearly, the respondents in 2007 have less appreciation of the impact of soil runoff than those in 2005. While all categories of educational attainment believe soil runoff pollutes, few in each category believe that it does so. Yet, in Figure 8, a greater percentage of respondents in 2007 are reporting themselves knowledgeable in most every educational category than in 2005.

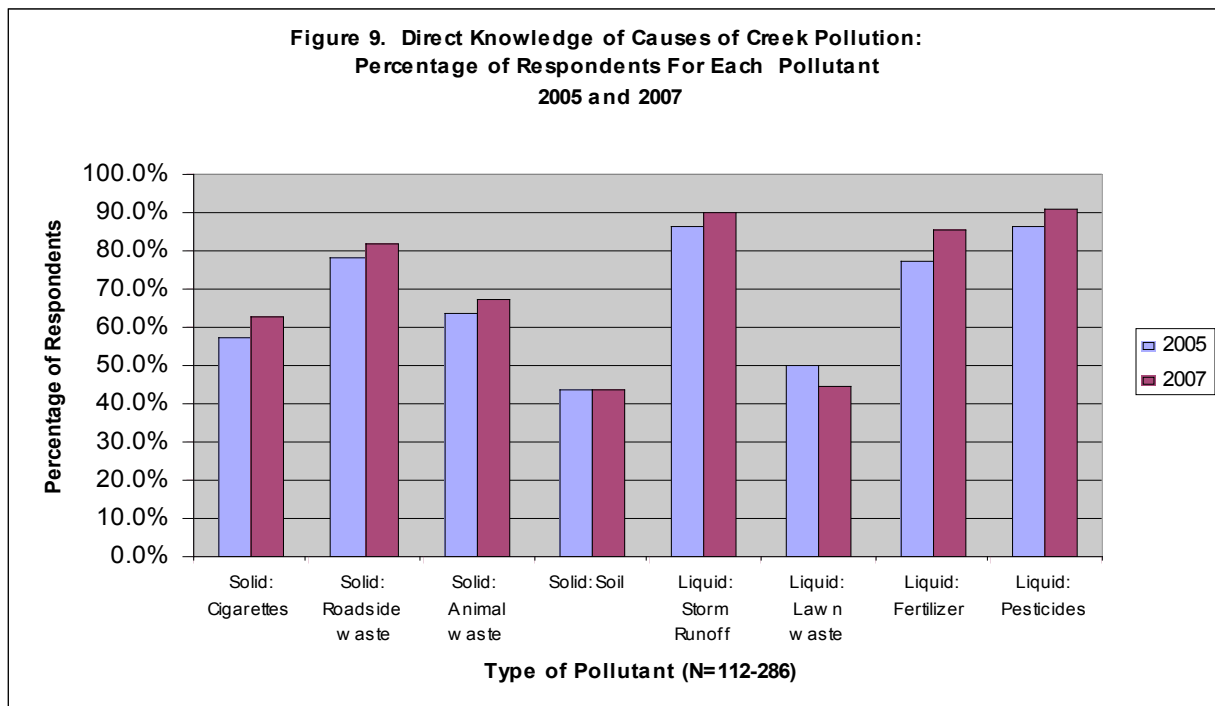


One result in the Graduate Degree category is somewhat peculiar; a slightly greater percentage of those with graduate degrees rate themselves as not knowledgeable. This could be an affect of the level of ambiguity of the question. What is considered knowledgeable by graduate standards (MA, MPA, MS, Doctorate) may be perceived differently than those with no degree.

Public Knowledge of Causes: Direct and Indirect Evidence

How much does the Chico public know specifically about the causes of water pollution? The survey included questions designed to access what the respondents knew, directly and indirectly, about how harmful pollutants create pollution of creeks and streams through water runoff via the storm drain system. One set of questions relates to which runoff items cause pollution of creeks. Another set of questions create indirect measures of knowledge of what influences water quality.

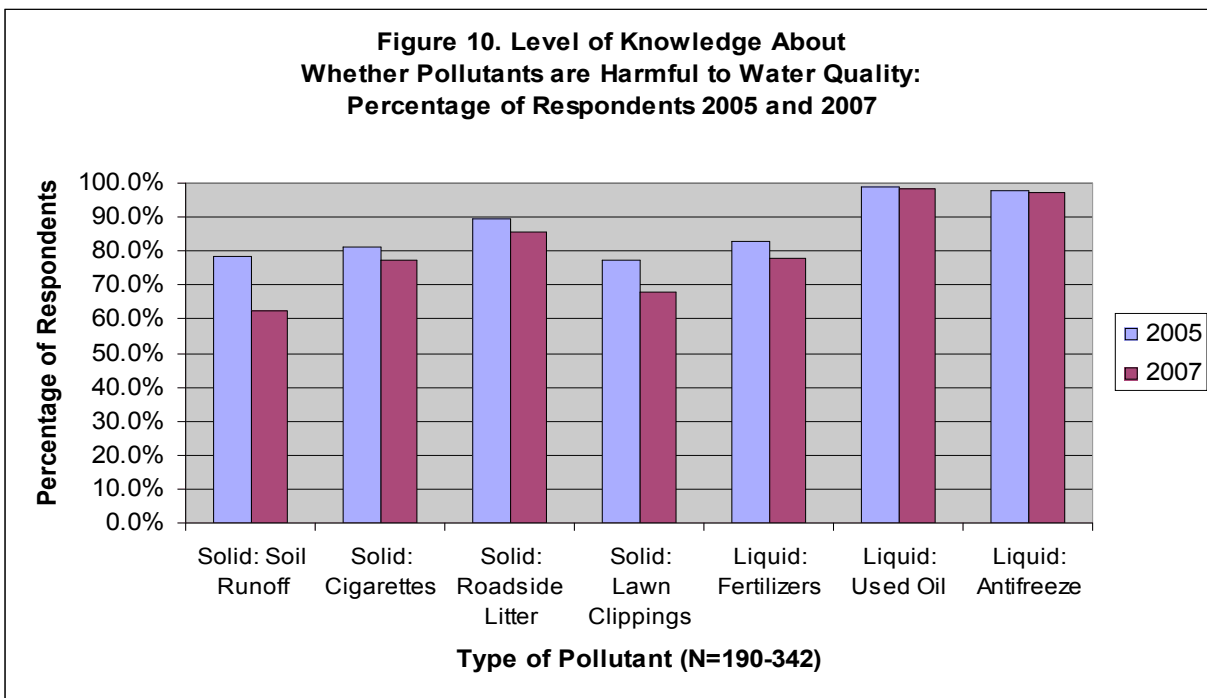
Level of Direct Knowledge of Creek Pollution Causes. Respondents were asked a series of questions about whether or not a variety of common residential items cause urban runoff pollution of creeks (q2, q2a1-8). These items include solid waste such as cigarettes, litter, animal waste, and lawn waste, and liquid waste such as fertilizer, pesticides, and stormwater runoff. As shown in Figure 9, a majority of the respondents in both 2005 and 2007 recognized that cigarettes, roadside waste, animal waste, stormwater runoff, fertilizer, and pesticides cause creek pollution.



A slightly higher percentage of the 2007 respondents recognize these pollutants in each category than those respondents in 2005. These items were the main foci of the outreach messages; this result suggests that the messages may have increased the public’s direct knowledge of creek pollution. Alternatively, less than half of the respondents recognized soil runoff or lawn waste as

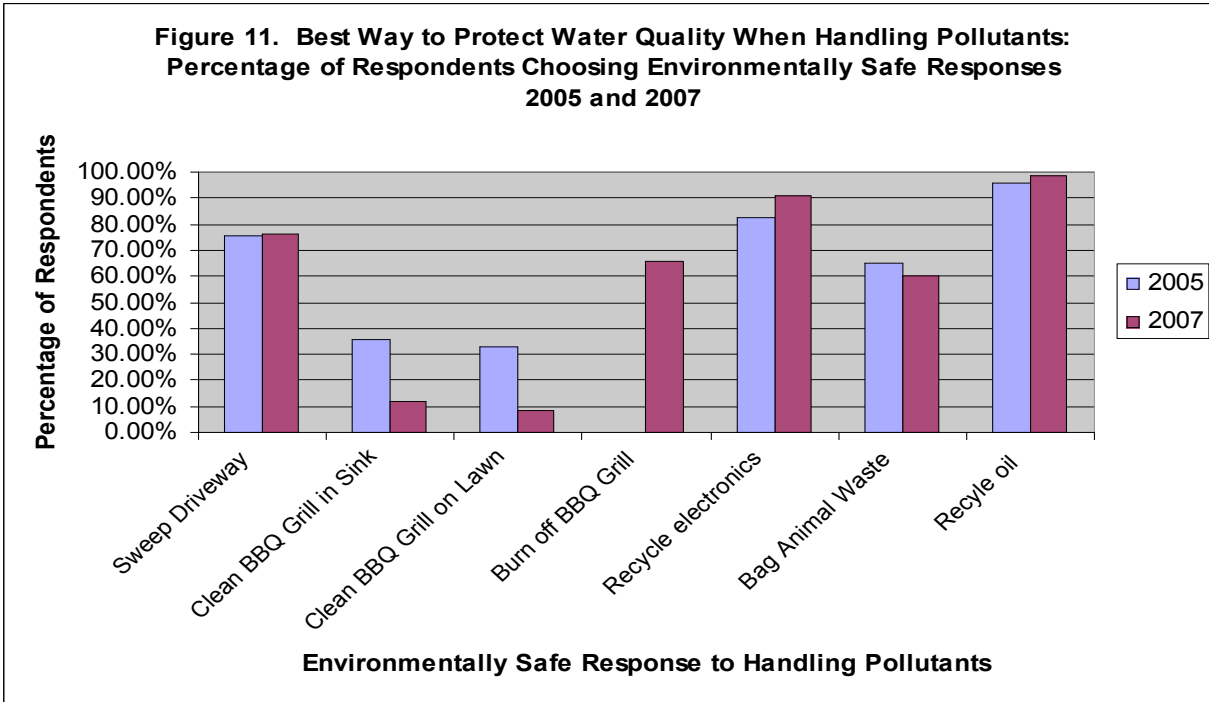
causes of creek pollution. This is interesting because these causes were given very little, if any attention, in the outreach messages and there are actually a lower percentage of the respondents in 2007 that recognize lawn waste as a pollutant. Given that there was an increase in recognition of pollution causes regarding items covered in the outreach messages, and little or less appreciation of those items that were not covered in the messages, it suggests that the outreach messages increased the public’s direct knowledge of the causes of creek pollution from runoff.

Another series of questions examine an alternative view of direct knowledge of whether various common residential items harm water quality (q18-q20, q22, q25, q27, q29). These items include solid waste such as cigarettes, lawn clippings, litter, and soil as well as liquid waste such as fertilizers, anti-freeze, and oil. Ideally, these questions are just another way of asking respondents if these kind of items cause pollution. Yet, as Figure 10 indicates, while a large percentage of respondents recognize that they can be harmful to water quality, fewer believe this in 2007 than in 2005.



This is a curiosity; even though the opinion shift in each item is fairly small, it is consistent across every item category. It is particularly different in soil and lawn clippings categories. This could be an affect of the question ambiguity. While the questions about causes of creek pollution directly state “...which of the following causes urban runoff pollution of creeks?” the questions about water quality are ambiguous. These questions ask, for example, “How harmful do you think fertilizers are to water quality?” which could be interpreted to mean drinking water quality not creek water quality. Such reference confusion may be a result of the concentration of the outreach messages on urban runoff impact on creeks and streams, so that 2007 respondents may not have associated these questions with creeks and streams because the question did not specify creeks and streams.

Level of Indirect Knowledge of Causes of Pollution. Another series of questions examine indirect knowledge of whether various common residential items harm water quality by asking respondents about the best way to dispose of toxic items such as used oil, electronics, and animal waste, or clean items such as BBQ grills and driveways (q3-q5, q23, q26). As shown in Figure 11, it is clear that most respondents in both 2005 and 2007 know how to handle the named pollutants for protecting water quality.



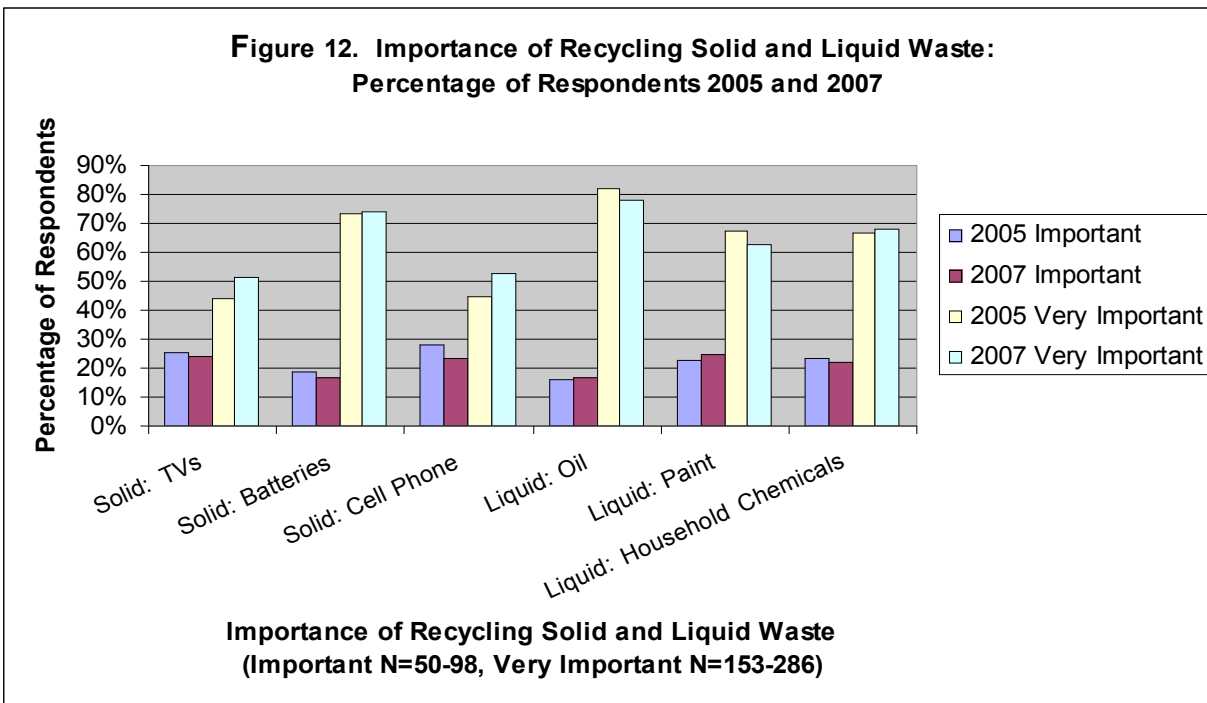
Although the response option of *burning off the BBQ grill* was not in the 2005 survey, it was often mentioned in the “other” category and is clearly a popular response to cleaning the grill in 2007. Otherwise, these data generally reflect knowledge of how to handle harmful pollutants for preserving water quality.

Public Attitudes About Importance of Water Quality Issues

Examining public attitudes is another way to examine how much the Chico public knows or values the importance of protecting water quality or preventing creek pollution from urban runoff. The survey provides questions to assess public attitudes from two perspectives. First, the questionnaire included a series of questions about the importance of recycling solid and liquid waste products. Second, the survey asks respondents about whether they materially support organizations that promote environmental concerns through a tax assessment or nonmaterially through supporting environmental organizations through volunteerism, attitude, etc.

Importance of Protecting Water Quality. Respondents were asked a series of questions about the importance of recycling solid waste such as TVs, cell phones, and batteries, and liquid waste such as paint, oil, and household chemicals (q 6-11). As Figure 12 indicates, in both 2005 and

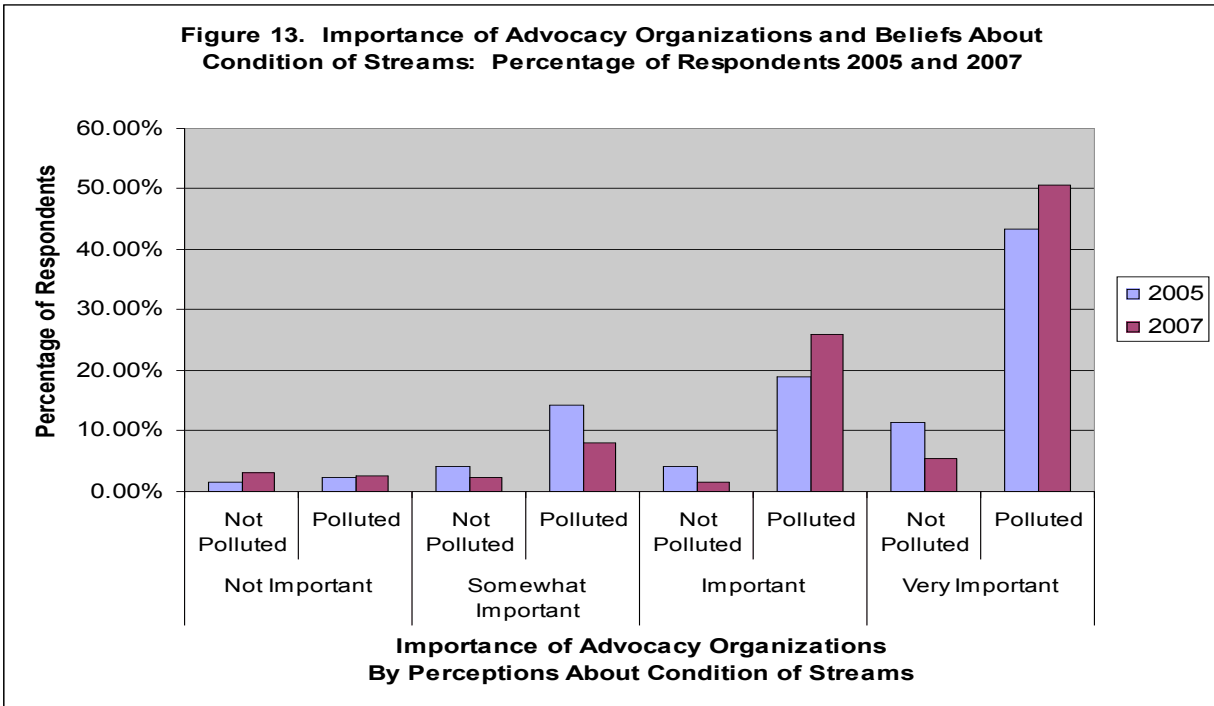
2007 respondents overwhelmingly thought that recycling solid and liquid waste was “very important.”



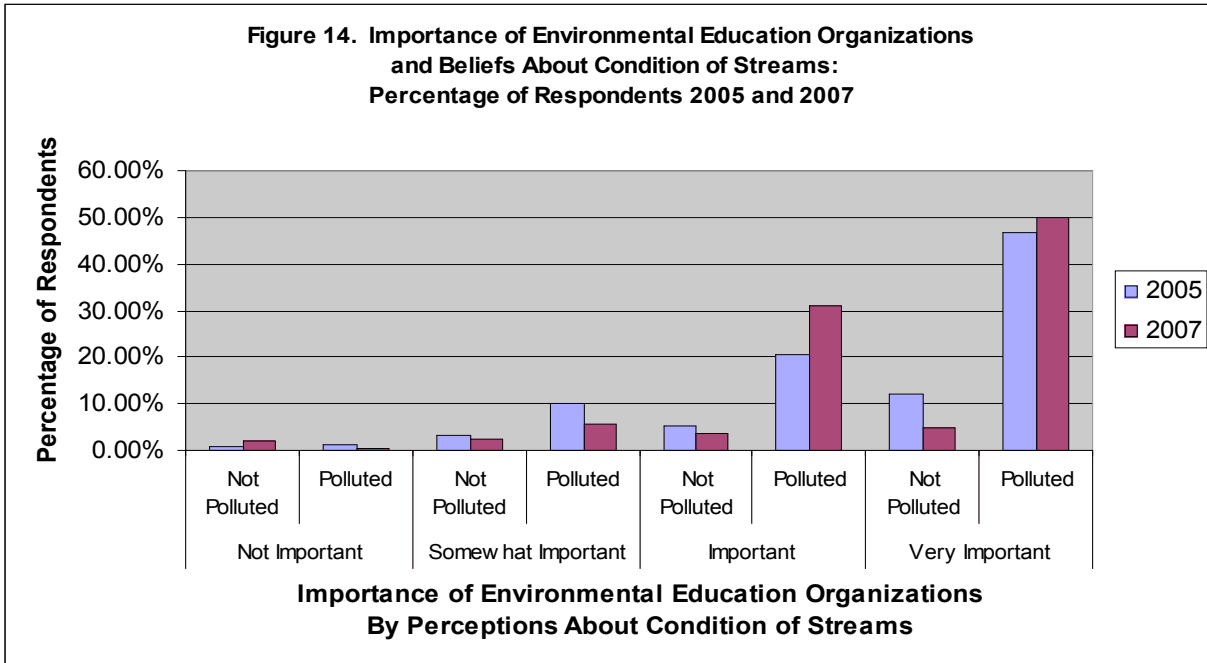
As Figure 12 shows, there has been very little change in how important respondents thought recycling these products is, with the exception of a modest increase in 2007 in the importance of recycling TVs, and cell phones. This is interesting because attitudes about recycling TVs and cell phones exhibits the most diversity of this set of products.

Importance of Supporting Environment Materially or Nonmaterially. The survey included two sets of questions regarding attitudes toward supporting environmental causes. One set of questions directly asks if respondents would pay either a \$25 or \$50 annual tax to help protect water quality (2005 q35 and q36, 2007 q36 and q37). Because of an inadvertent question order reversal in 2007, the responses are not comparable across the 2005 and 2007 data sets. In 2005, respondents were first asked if they would pay \$25 and 73% answered yes, and 47.2% answered they would pay \$50 to protect water quality. In 2007, respondents were asked first if they would pay \$50, and 59.2% said they would. Those who responded that they would not pay \$50, were then asked if they would pay \$25 to protect water quality. Of those who said they would pay \$25 but not \$50, 30.3% said they would pay the \$25 annual tax. This suggests that a larger percentage of respondents in 2007 would pay at most a \$50 annual tax for protecting water quality. This implies that support for protecting water quality materially has increased since 2005. This too may be a result of the heightened saliency of water issues due to the outreach promotions.

In addition to material support, the survey results also provide data on public attitudes toward environmental organizations (q 33.34). Figure 13 shows that public support for environmental advocacy organizations is higher and more important among respondents who perceive the creeks and streams to be polluted (q1). This relationship exists in both the 2005 and 2007, but the percentage of respondents who believe that environmental advocacy organizations are important or very important is much higher in 2007.



This same relationship holds true for public support for environmental education organizations (q34.35). As seen in Figure 14, the percentage of respondents who believe that such organizations are important or very important is much higher for those who believe the creeks and streams to be polluted (q1).

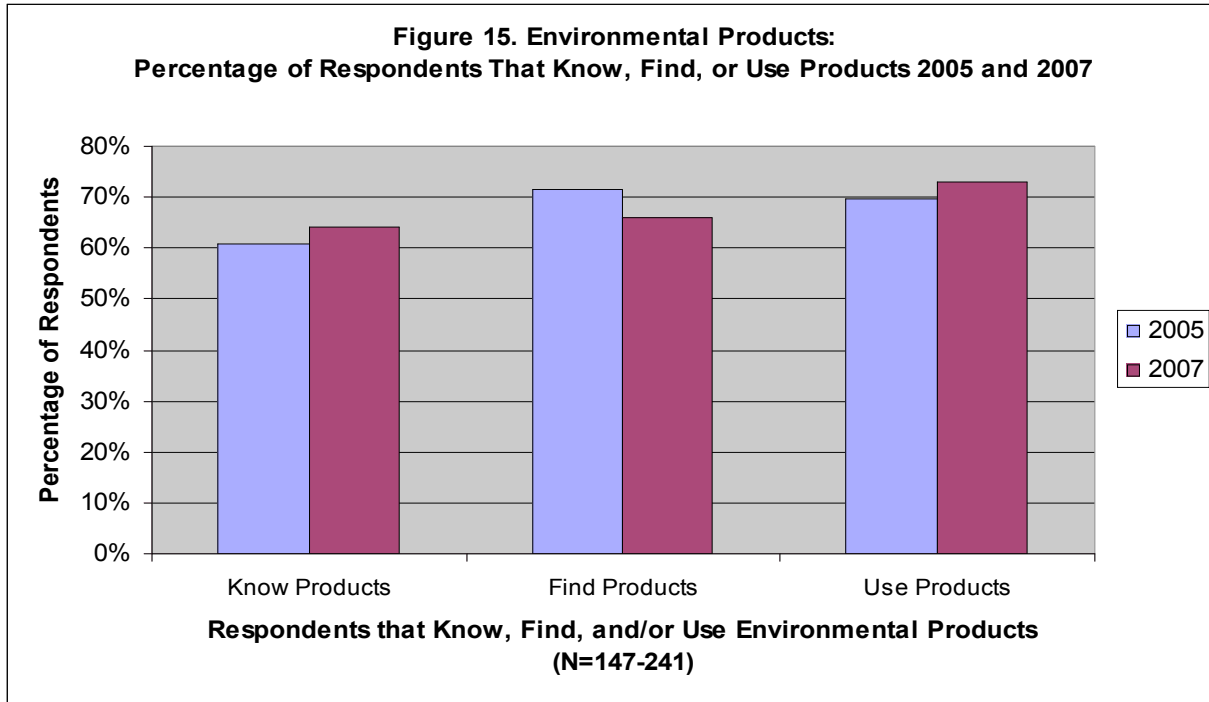


As Figure 14 suggests, support for environmental education organizations is much higher in 2007 than it is in 2005, suggesting perhaps an appreciation for the outreach messages.

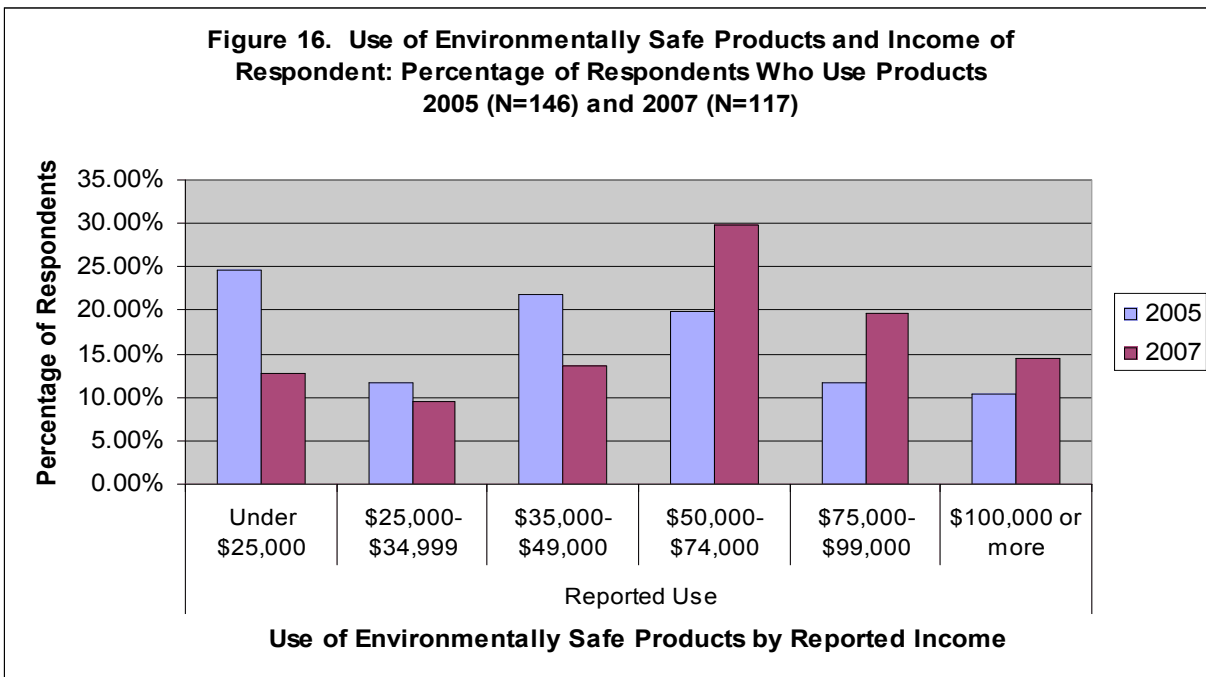
Evidence of Environmentally Knowledgeable Behavior

It is one thing for the Chico public to acknowledge an appreciation for the causes of water quality problems and to espouse supportive attitudes toward addressing them, yet it is quite another matter to act on the principles and beliefs underlying these attitudes. Both the 2005 and 2007 surveys asked questions about knowledge of environmentally friendly products and environmentally friendly behavior. These questions were designed to elicit not only knowledge of products but active use of such products.

Knowledge of Environmental Products. The survey asked respondents if they knew of environmental products, could find such products, and use such products (q12-q14). As Figure 15 shows, there was a slight positive change in the knowledge and use of environmentally friendly products from 2005 to 2007.

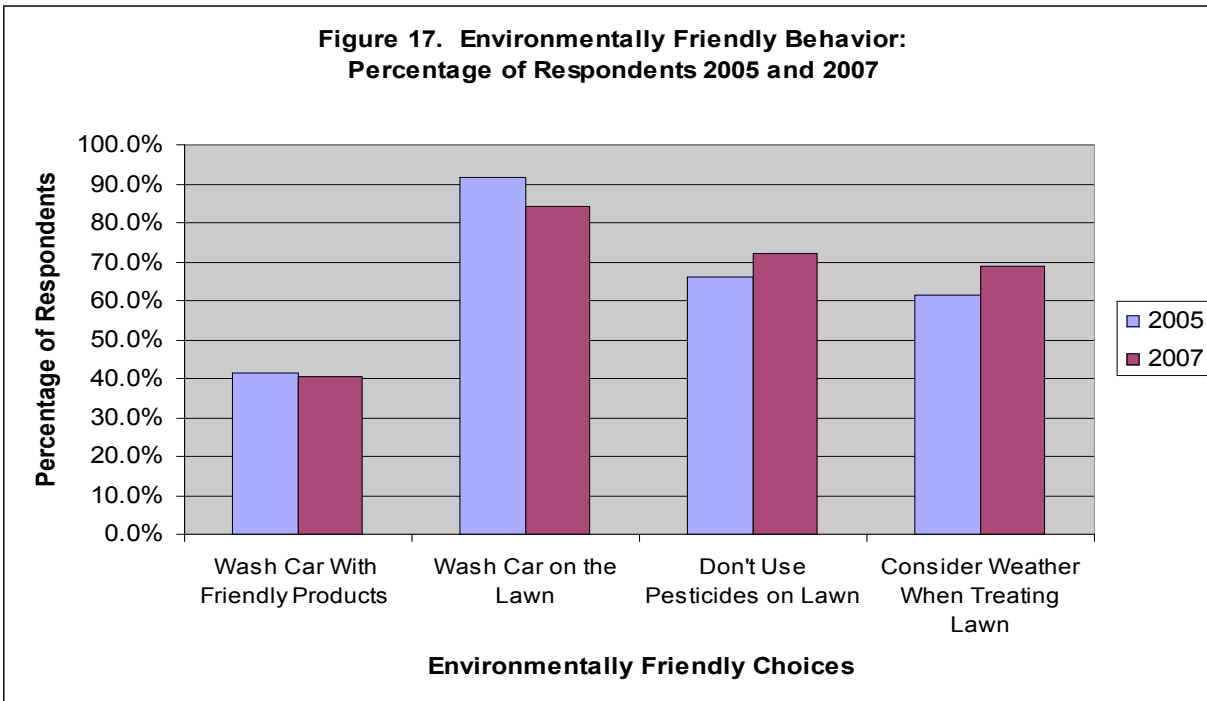


In both 2005 and 2007, at least 60% or more of the respondents know of, can find, or use such products. Yet, these data hide a systemic problem with expecting people to act on their beliefs. As Figure 16 demonstrates, there is a significant difference between lower income and upper income respondents and their use of environmentally friendly products.



It appears that use of environmentally friendly products is among a higher percentage of respondents reporting \$50,000 or more as income. This is especially true for those reporting use of such products in 2007.

Environmentally Friendly Behavior. Another way of assessing whether respondents act on their beliefs is to ask them how they wash their cars, garden, dispose of green waste, and dispose of oil (q15-24a). As seen in Figure 17, slightly higher percentages of respondents in 2007 do not use pesticides and will consider the weather when treating their lawns than in 2005.



These results are important because reduction of pesticide use and careful lawn treatment were subjects of the outreach messages in 2006. They also imply some attempt to respond to these messages may have occurred. This figure also shows that a lower percentage of respondents are washing their cars on the lawn while a nearly equal number do so with environmentally friendly products. This could suggest that more respondents are taking their cars to the car wash given that one set of outreach messages recommend commercial car washes as alternatives to home car washing.

EVIDENCE OF DIRECT/INDIRECT IMPACT OF OUTREACH PROGRAM

The goals of the outreach program were to increase public awareness of water quality issues, improve public knowledge of the causes of water pollution, encourage positive attitudes toward protecting water quality, and stimulate environmentally responsible behavior. The results of the comparisons between the 2005 and 2007 survey results suggest that respondents in 2007 appeared to be aware and knowledgeable about runoff water quality issues, are supportive materially and nonmaterially of water quality causes, and have made many positive changes in

environmentally responsible behavior. To provide further validation to these findings, the following examines additional evidence of the direct and indirect impact of the outreach program using cross-tabular analysis of the 2007 data regarding self-reported changes.

Direct Evidence of Outreach Impact

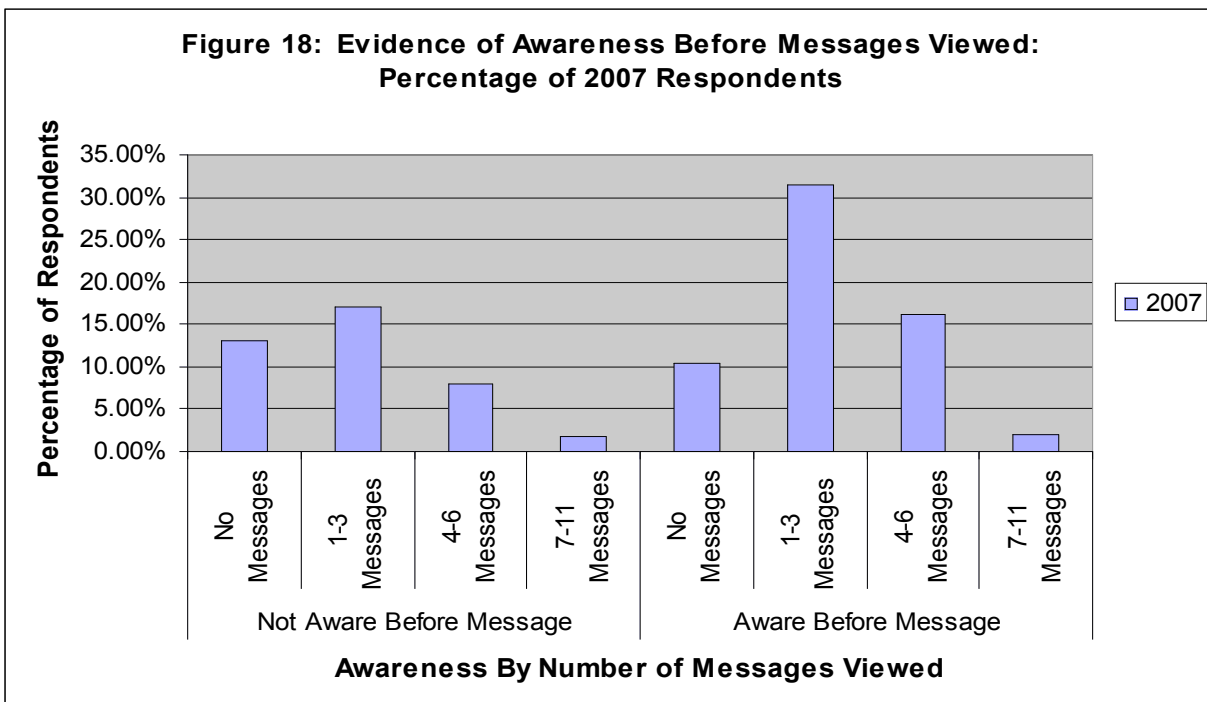
The 2007 survey had three important variables measuring the impact of the Outreach Program. These variables are:

Q31: *Which of the following educational messages about potential for polluted water runoff from yards, driveways, and gutters directly to the creek did you hear or see last year?*

Q32: *Were you aware of the fact that water runoff from your yard, driveway, and gutter drains directly into our creeks and streams before hearing or reading this message?*

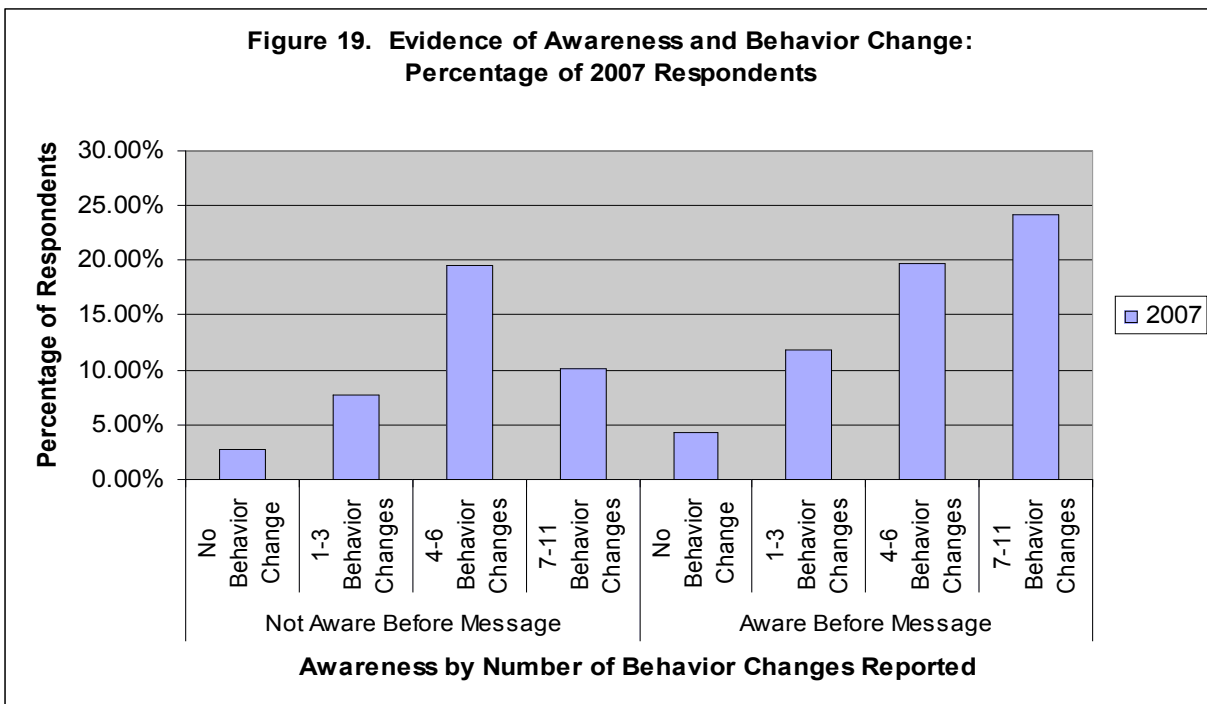
Q33: *Which of the following behaviors have you changed to protect our local creeks and streams from polluted water runoff?*

Outreach Messages and Awareness. To simplify and clarify the data relationships, q31 was recoded into an index entitled *Outreach Cat* to classify how many outreach products respondents reported having seen or heard. This is so that no message viewed is the smallest category, and the largest number of messages viewed was categorized as 7-11. This index was cross-tabbed with q32 to indicate whether the respondent was aware of the issues before hearing the messages and how many different messages they heard. As seen in Figure 18, most people who heard or saw the messages also were aware of the issues before exposure to the outreach messages.



Yet, as many as 17% of respondents hearing or reading 1 to 3 messages did not know about the issues before being exposed to the outreach messages.

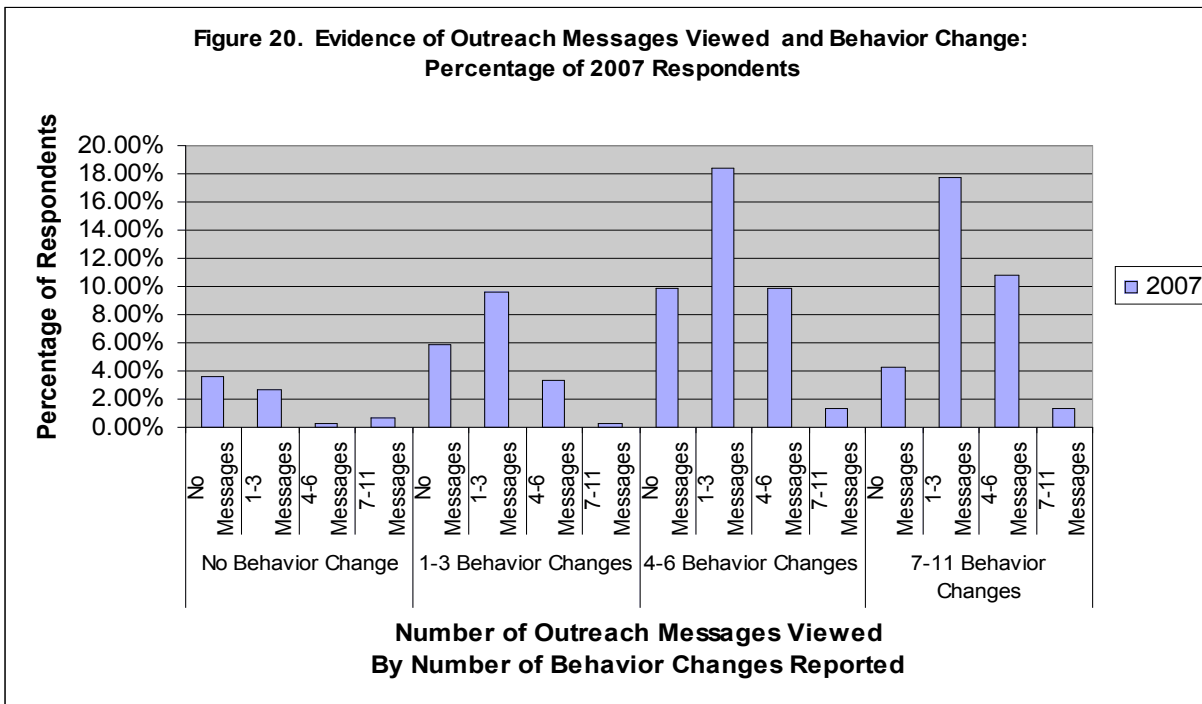
Behavior Change and Awareness. To simplify and clarify data relationships, q33 was recoded into an index entitled *Behavior Cat* to classify how many changes in behavior targeted by the outreach respondents reported having made. This is so that no change in behavior is the smallest category, and the largest number of behavioral changes reported was categorized as 7-11. This index was cross-tabbed with q32 to indicate whether the respondent was aware of the issues before hearing the messages and relate it to whether the respondent made changes consistent with the messages. As Figure 19 indicates, respondents reported many changes of behavior regardless of their awareness of the issues before viewing or hearing the outreach messages.



The evidence provides an interesting pattern. Nearly 20% of respondents who did not know about the issues prior to the outreach have made 4-6 changes consistent with the outreach program goals. Ironically, most of the changes in behavior were made by those respondents reporting that they were aware of the issues prior to experiencing the outreach messages. This kind of responsiveness is greater than anticipated in the outreach program. Ideally, the outreach program goal was to stimulate 1-3 changes, yet in both aware and unaware respondents, nearly 20% made 4-6 changes. To achieve 7-11 changes, some of the changes required possessing cars, having lawns, owning pets, or smoking cigarettes. This suggests that the outreach had a greater than intended impact on environmentally friendly behavior targeted by the outreach messages.

Outreach Messages and Behavioral Changes Reported. To measure the relationship between exposure to outreach messages and behavior changes consistent with the messages, the *Outreach Cat* variable was cross-tabbed with the *Behavior Cat* variable. As Figure 20 suggests, the

highest percentages of respondents reporting the highest number of changes are those that have viewed 1-3 or 4-6 outreach messages.



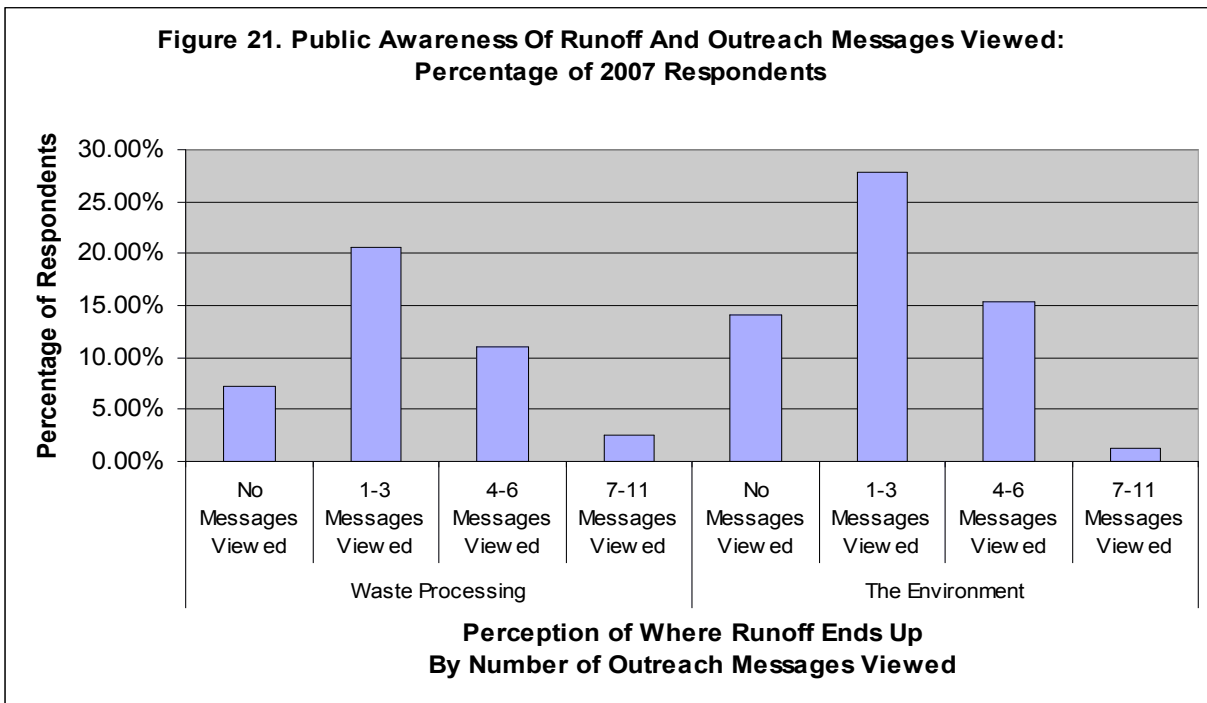
This suggests that the outreach messages had a greater impact on behavior change than expected. Notice, there is a very small percentage of respondents reporting no change, and, as many as 10% of the respondents with 4-6 changes report having viewed no messages at all. Thus, although behavior changes were not necessarily related to the outreach messages, that those who saw or heard 1-6 messages made changes in the direct of the outreach messages, suggests the outreach program achieved success in changing individual behavior.

Indirect Evidence of Outreach Impact

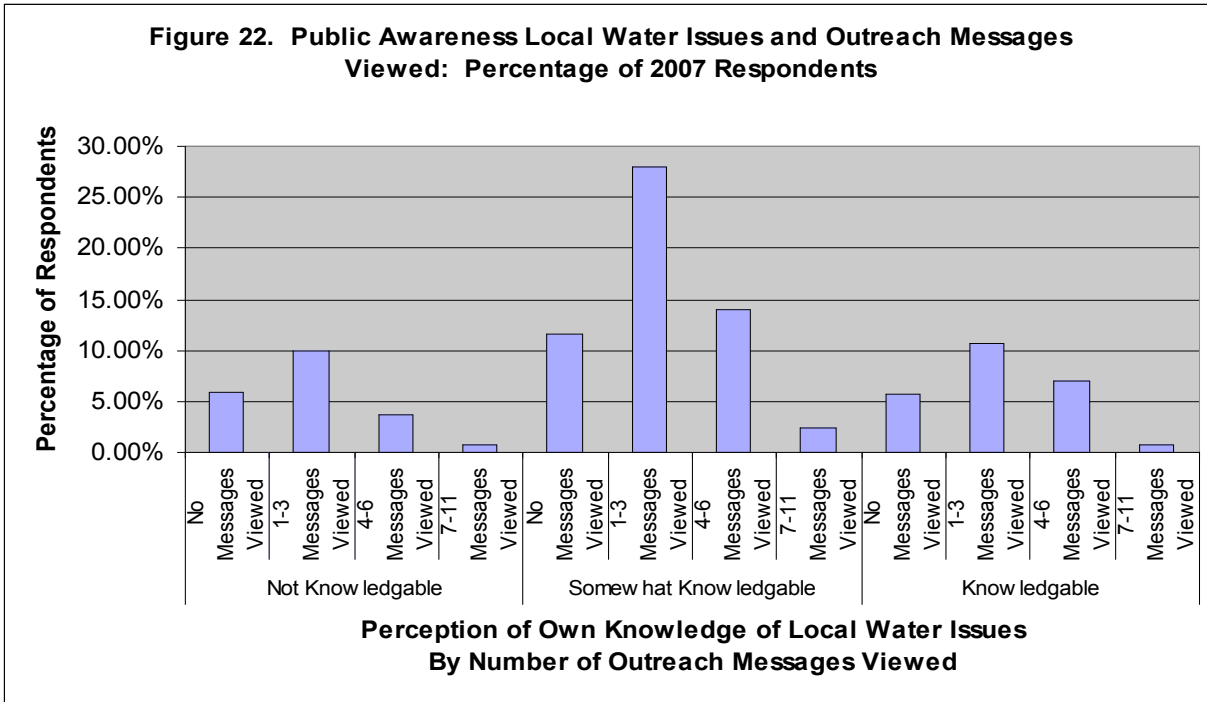
In theory, respondents who viewed messages should have higher environmental awareness, knowledge of causes of poor water quality, more supportive attitudes for protecting water quality, and exhibit environmentally friendly behavior regarding the targeted pollutants than those who did not view the messages. Yet it is not clear what level of awareness, knowledge, support, or behavior differences exists between those respondents who knew the information before the messages and those who did not know. By examining the differences between those who did not know and those who did, the examination will provide additional validation or indicators about the effectiveness of the outreach program.

Public Awareness. The survey had two main questions on general public awareness about water quality issues for streams and creeks. Q16 asks respondents where they think runoff ends up and q30 asks them to rate their own knowledge of local water issues. By cross-tabbing q16 with *Outreach Cat* (recoded q31), Figure 21 shows the relationship between where respondents think

runoff ends up (either waste processing or the environment) and their exposure to outreach program products.



As Figure 21 indicates, a greater percentage of respondents who have viewed the outreach messages answered “correctly” that runoff ends up in the environment. Yet, the percentage of respondents answering “the environment” that saw or heard no messages at all is nearly the same as the percentage that have seen or heard 4-6 messages. This may be due to the high level of knowledge about environmental issues that already existed in the community. Figure 22 supports this suggestion by illustrating the relationship between the respondents’ perception of their own knowledge of water issues and the number of outreach messages viewed.



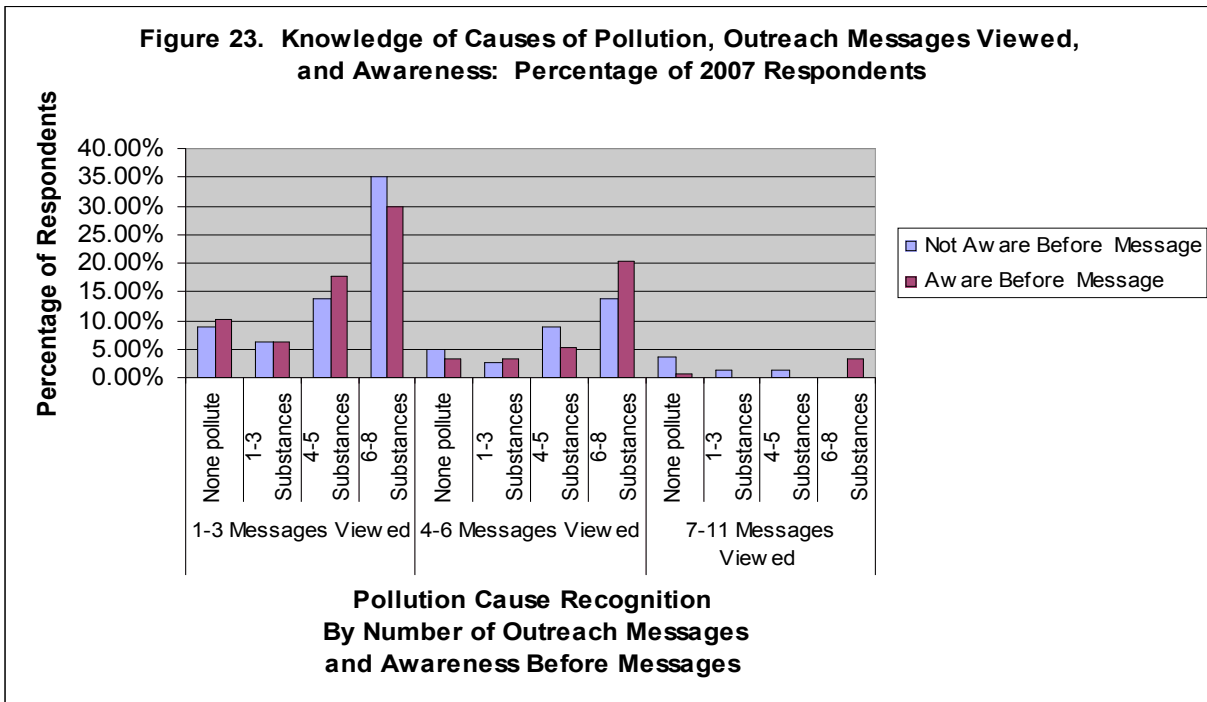
As Figure 22 shows, the percentage of respondents who consider themselves not knowledgeable is under 10% of the respondents regardless of their exposure to the outreach messages. The percentage of respondents that are somewhat knowledgeable who were not exposed to outreach messages is slightly over 10% but those who viewed 1-3 messages and considered themselves somewhat knowledgeable comprised 28% of the respondents. This suggests that there are a greater percentage of respondents who viewed or heard outreach messages who reported they are knowledgeable or somewhat knowledgeable about local water issues than those who did not view any messages.

Public Knowledge of Cause. The data so far suggest that the respondents are at least somewhat confident in their knowledge of water issues, yet, how much of that knowledge is related to the outreach messages is difficult to determine. One way to approach how much impact the outreach messages might have had on knowledge is to examine a cross-tabulation of causes of water pollution with outreach messages (*Outreach Cat*) which provide information about causes of water pollution, about whether types of pollutants are harmful, and the best way to handle potential pollutants and with q32 where respondents stated whether they knew the information prior to viewing or hearing the outreach messages. Q2a1- q2a 7) asks respondents if cigarettes, roadside litter, animal waste, fertilizer, soil, and lawn waste cause urban runoff pollution of creeks. These questions were used to create an index of how many of the substances the respondents correctly identified as pollutants. The index was classified as follows:

Pollution Cat:

- 0 = € None pollute
- 1 = € 1-3 substances pollute
- 2 = € 4-5 substances pollute
- 3 = € 6-8 substances pollute

As Figure 23 shows, the largest percentage of those who recognized most if not all of the substances as pollutants viewed 1-3 messages with those who were aware of the issues comprising 30% of the respondents and those who were not aware comprising 35%.



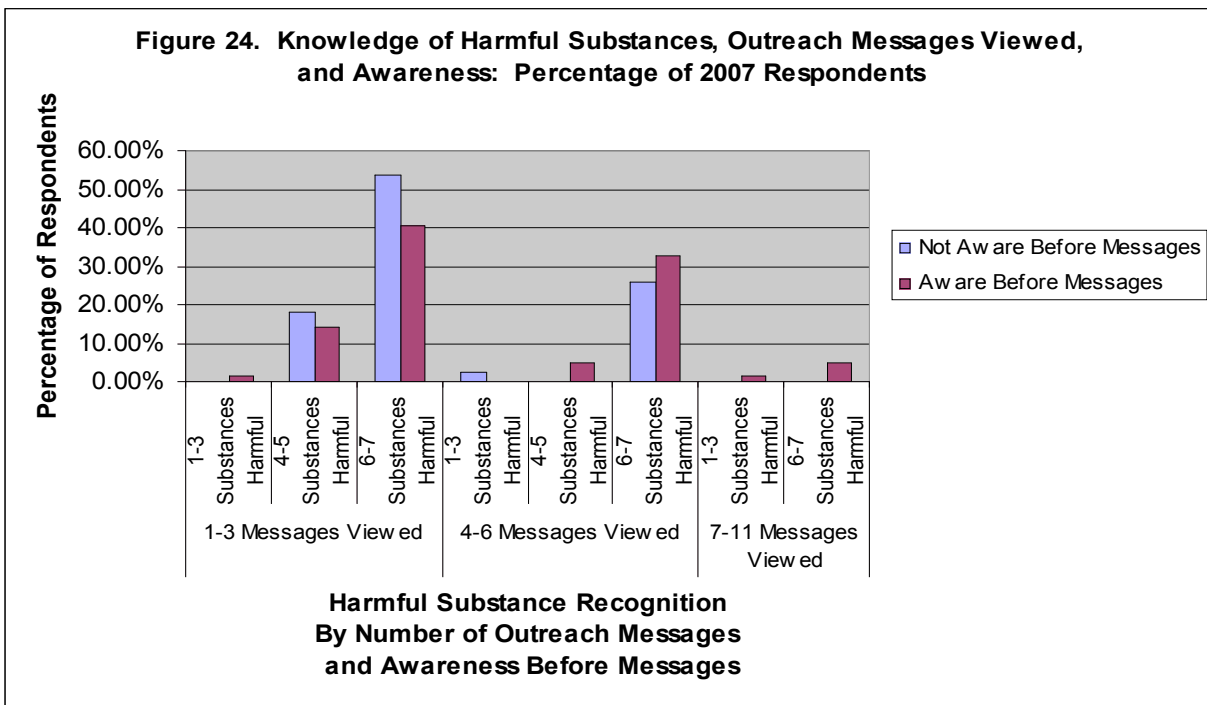
Those who recognized the most number of pollutants also were the highest percentage of respondents who viewed 4-6 messages. This suggests the outreach messages may have sensitized both those who were aware of the issues as well as those who were not.

In addition to recognizing substances as pollutants, respondents should also recognize that such substances are harmful if the outreach messages effectively communicated the issues of runoff pollution from such substances. To address this, the survey asked respondents if fertilizers, cigarette butts, anti-freeze, lawn clippings, oil, litter, and soil runoff were harmful to water quality (q19-q22, q25, q27, q29). To address this, these questions were used to create an index and then classified by number of substances correctly identified as being harmful. The resulting data, *HarmCat*, were recoded as follows:

HarmCat:

- 0 = € None harm
- 1 = € 1-3 substances harm
- 2 = € 4-5 substances harm
- 3 = € 6-7 substances harm

As Figure 24 demonstrates, a high percentage of those respondents who correctly identified 4-5 or 6-7 substances as harmful, had not known about the issues of runoff pollution prior to viewing or hearing messages.



The largest percentage of the respondents, 53%, who correctly identified 6-7 substances as harmful had not known about runoff issues prior to viewing or hearing 1-3 outreach messages. Given that these messages focused on sensitizing the public to the harmfulness of substances including those referred to in q19-q22, q25, q27, q29, the data suggest that the outreach messages were effective in sensitizing the public to issues regarding these substances.

Another way to measure the effectiveness of the outreach messages is to examine if the respondents appear to understand how to avoid toxic runoff issues. Questions 3-5 and 23-26 ask respondents for the best way to clean or dispose of a variety of everyday substances. Respondents were asked the best way to clean sidewalks or driveways and BBQ grills. They were also asked the best way or permissible way to dispose of electronics, animal waste, and used oil. To assess this, the best way questions were recoded into an index and then into categories creating *BestWay Cat* as follows:

BestWay Cat

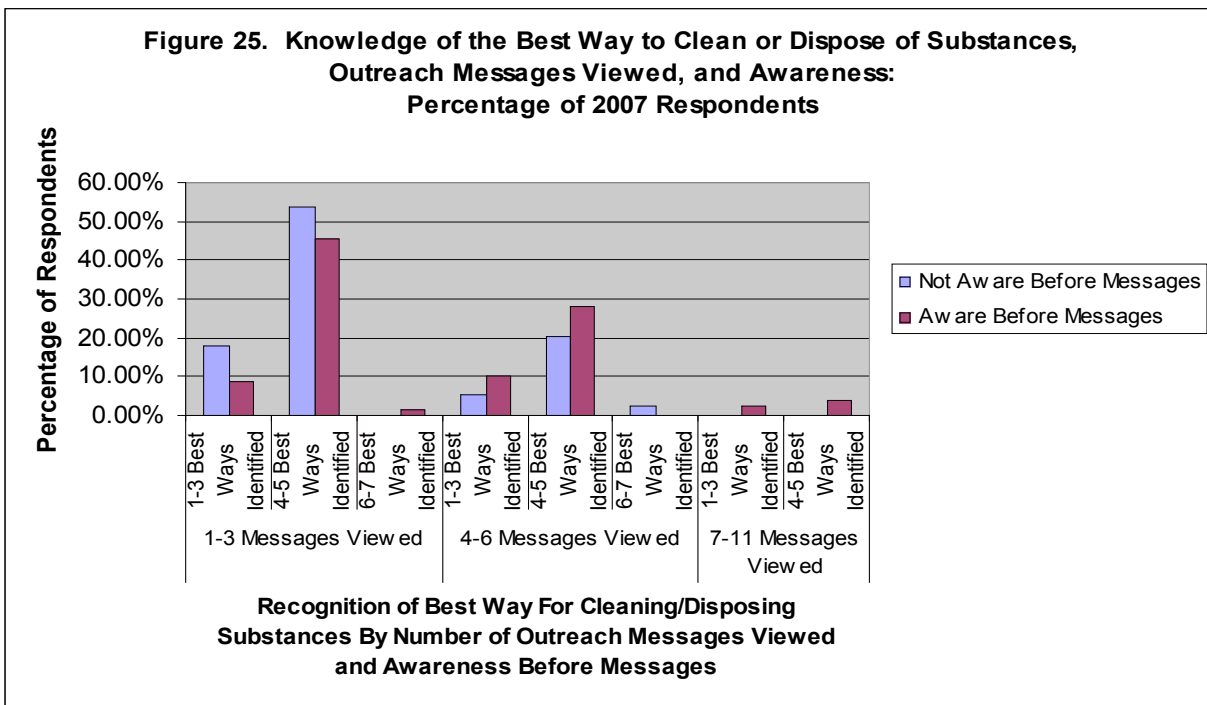
0 = € No bestway

1 = € 1-3 bestway

2 = € 4-5 bestway

3 = € 6-7 bestway

Figure 25 shows that the highest percentage of respondents who correctly identified 1-3 best ways and 4-5 best ways also viewed or heard 1-3 messages and reported they were not aware of runoff issues prior to viewing or hearing the messages.



Although the percentage respondents correctly identifying 6-7 best ways is small, the percentage of respondents correctly identifying 4-5 best ways to clean or dispose of substances is 21% for those who were not aware and 28% for those who were aware of the issues prior to exposure to 4-6 of the outreach messages. For those who were exposed to 1-3 outreach messages, 54% of those who were unaware of the issues prior to the messages correctly identified 4-5 of the best ways. Those who were aware of the issues and viewed 1-3 messages correctly identified 4-5 of the best ways. These results provide further support for suggesting that the outreach messages were effective in creating not only an awareness of the issues, but an understanding of how to address these issues in practice.

Attitudes. Not only were the outreach messages intended to inform the public about runoff issues but they were also intend to heighten the saliency of recycling as a way of reducing the opportunities for runoff pollution. The survey asked respondents about how important it was to

recycle TVs, oil, batteries, paint, cell phones, and household chemicals. To examine this, an index was created out of q6-q11 on the number of these substances correctly identified as important to recycle. The index was then cross-tabbed with *Awareness* (q32) and *Outreach Cat* to see the relationship between saliency, awareness, and outreach message exposure. Figure 26 shows that of those who viewed or hear 1-3 messages, the highest percentage of the respondents correctly identified all 6 substances as important to recycle.

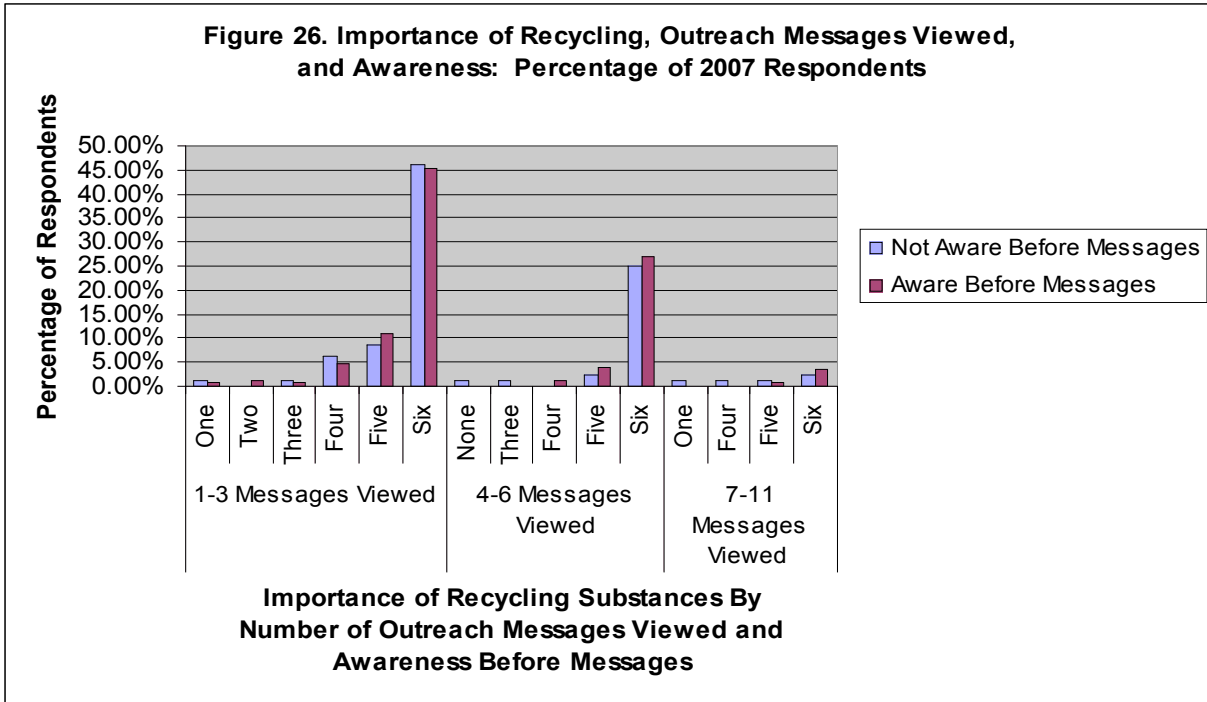


Figure 26 also shows those who were aware of the runoff issues prior to being exposed to the messages comprised 45% of those also correctly identified 6 substances and who viewed or heard 1-3 messages. Those respondents who said they were not aware of runoff issues comprised 46% of respondents who also correctly identified 6 substances and who were exposed to 1-3 messages. Those respondents who viewed 4-5 messages comprised 25% of the unaware and 27% of the aware who also identified all 6 substances as important to recycle.

Environmentally Friendly Activities. Additional questions in the survey ask respondents how they handle everyday activities including whether or not they have knowledge of environmentally friendly products and where to find such products, and whether they use these products in general and specifically when washing their cars. In addition, the survey includes questions on the use of pesticides, disposal of green waste, and disposal of oil. These questions, including q12-q14, q15b, q15c3, q17a, q17b, q18a, q18d, q24a, were placed into an index of activities that were environmentally friendly. To simplify the index, it was recoded as *Env Friendly Cat* as follows:

Env Friendly Cat

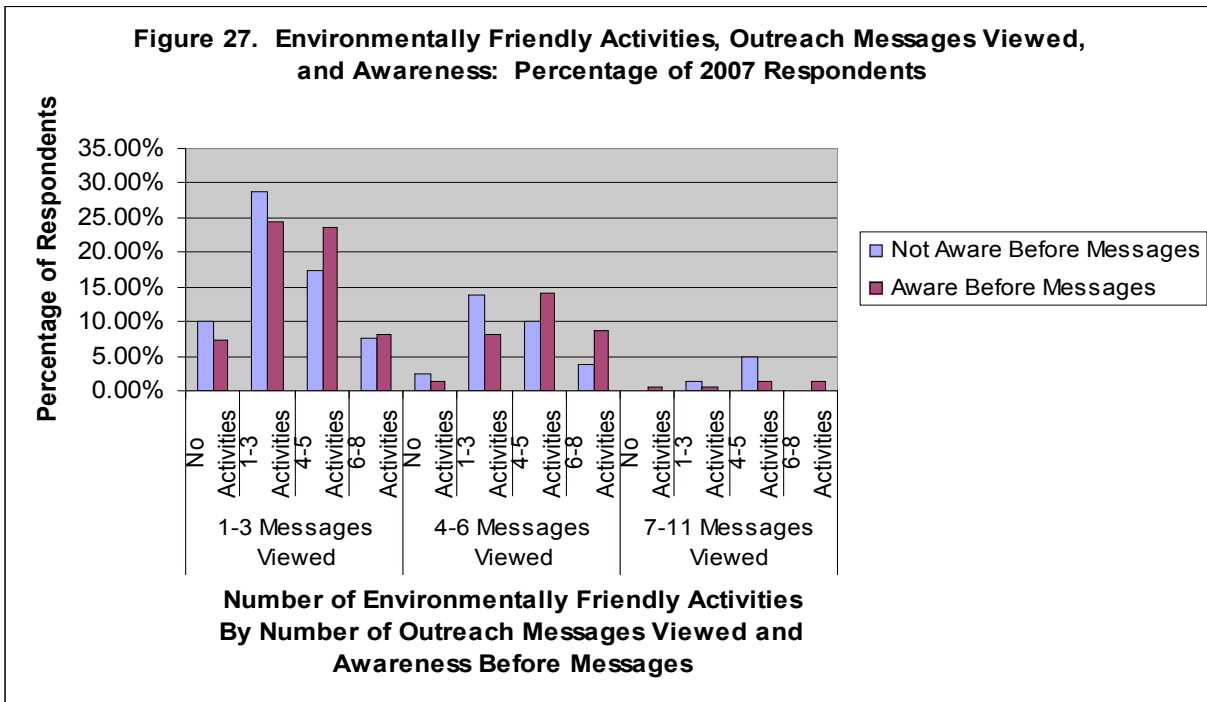
0 = € No Activities

1 = € 1-3 Activities

2 = € 4-5 Activities

3 = € 6-8 Activities

As Figure 27 shows, the pattern found in the above analyses is similar for these data. Respondents who viewed 1-3 messages have the highest percentage of respondents reporting 1-3 environmentally friendly activities and 4-5 environmentally friendly activities.



Twenty-nine percent of those who were not aware of runoff issues before being exposed to outreach messages have 1-3 activities and viewed 1-3 outreach messages. As in earlier discussions, those respondents who viewed or heard the outreach messages are engaging in environmentally friendly activities consistent with the outreach messages.

Support for Environment. Finally, in addition to identifying activities that exhibit the preferred behavior from respondents, the survey also asked questions to test whether respondents support environmental causes either materially through taxes or nonmaterially through support for environmental advocacy and education organizations (q33/34, q34/35, q35/36/, q36/37). To measure support, these questions were recoded so that *Support Index* is defined as the organization is important to the respondent and/or the respondent would pay a tax. The number of support responses was summed 0-3. Figure 28 shows the relationship between the number of supportive responses, number of messages viewed or heard, and awareness before hearing or viewing the messages.

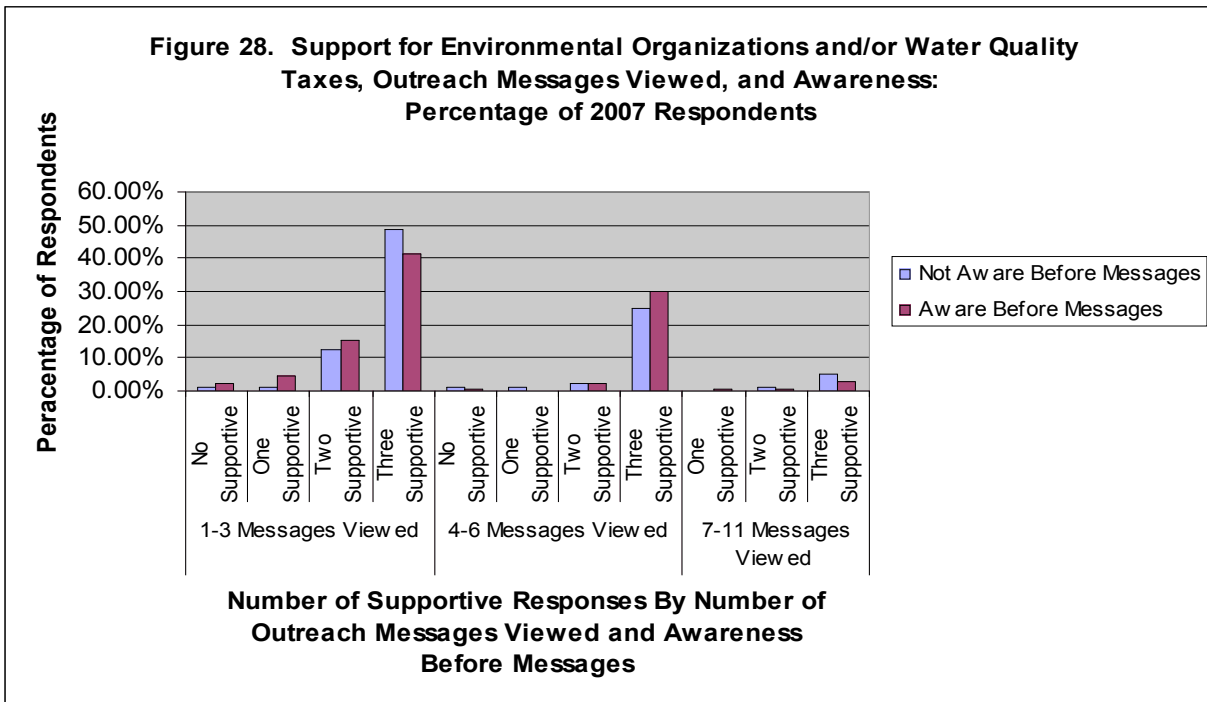


Figure 28 shows that respondents who had the highest number of supportive responses (3) comprised the greatest percentage of those who viewed 1-3 outreach messages. This is true as well for respondents who viewed 4-6 messages. Of those respondents who were not aware of the runoff issues before being exposed to 1-3 messages, 49% provided the maximum number of supportive responses. Of those respondents who were aware of the runoff issues before being exposed to 1-3 messages, 41% provided the maximum number of supportive responses. This suggests that the outreach messages may have stimulated support for environmental causes.

CONCLUSION

The Public Knowledge Surveys of 2005 and 2007 had different goals. The Public Knowledge Survey of 2005 was a needs assessment designed to identify public awareness, knowledge, attitudes, and behavior regarding water quality issues related to runoff pollution. Based on the outcome of the 2005 survey, BEC initiated an EOP designed to improve public awareness, knowledge, attitudes, and behavior. By using a multi-media, multi-faceted approach, BEC sought to change how the Chico, CA public viewed the importance of water quality issues, instill knowledge of best management practices for run-off prevention, and improve how the public implements best management behavior in everyday life. To examine the impact of the EOP, BEC administered a Public Knowledge Survey in 2007 with a few altered questions designed specially to address exposure to the EOP messages. To this end, the comparative results between 2005 and 2007 responses to the surveys, as well as in-depth analysis of the 2007 responses related to the EOP messages suggest that the EOP was successful in changing attitudes, knowledge, behavior, and public awareness regarding local run-off pollution issues.

Effective Outreach Media Messages

Respondents in the 2007 survey were asked to report which, if any, of the outreach messages they received during the 2006 outreach campaign. The majority of respondents who saw or heard an educational message, reported seeing the storm drain markers, followed by the murals, newspaper, and television messages. Due to an oversight in the survey questionnaire, the storm drain markers were not included in the list of outreach messages for respondents to choose from, and hence the overwhelming majority of those who reported seeing the markers indicate that these markers are a highly effective outreach tool. It is therefore recommended by this study that the City of Chico continue the program of marking the targeted number of storm drains in the storm water management plan.

Developed Awareness Achieved

A large portion of respondents acknowledged seeing or hearing educational messages and reported to have behaved consistent with the values and activities promoted by the messages. In 2007, as many as 17% of respondents reported they were unaware of the issues before seeing the outreach messages and have made 4-6 changes in their environmental behavior. Ironically, most of the behavior changes were identified to those who saw the outreach messages but were already aware of the issues. This suggests that the outreach messages heightened the saliency of run-off pollution issues for those already knowledgeable, as well as provided actionable information to those previously unaware of the run-off issues. Not only could both the aware and unaware respondents demonstrate an understanding of local run-off issues, but could also identify most of the substances targeted in the outreach messages as being harmful pollutants. Both sets of respondents were also able to identify the best way of handling such pollutants in a manner consistent with the outreach messages.

Improved Knowledge Apparent

More respondents in 2007 identified themselves as knowledgeable about runoff and water quality issues. According to the data, education level and length of residency influenced self reported level of knowledge. There is some evidence that issue complexity and term ambiguity influenced coherence of question responses regarding level of knowledge about the outreach issues. Yet, indicators of direct and indirect public knowledge suggests that the outreach messages increased public knowledge of creek pollution regarding some common solid waste (e.g. animal and roadside waste, TVs, cell phones) and liquid waste (e.g. fertilizer, oil, chemicals) pollutants.

Behavior Changes Evident

Most respondents who reported change, did so in the direction of the outreach messages, and made 4 to 8 changes in their environmental behavior. Respondents who acknowledged that they were unaware of the run-off issues in the outreach messages comprised a greater percentage of those who changed their environmental behavior. Among the behavioral changes is the increased percentage of respondents from 2005 to 2007 who indicate they know the best ways to protect water quality and practice such techniques. One result from the data suggests that ability

to influence environmental behavior maybe limited by income. Upper income respondents, especially in the 2007 survey results, had a high percentage of use of environmental products whereas lower incomes reported less usage. In future EOPs, the outreach messages may need to focus on value savings of environmental products or low cost substitutes for environmental products.

Attitudes Modified Positively

Although the outreach messages were designed to increase awareness and knowledge of local run-off pollution issues, and induce behavioral changes in accordance with those messages, the EOP also created additional public material and nonmaterial support for environmental protection. The data suggest that material support, willingness to pay a lump sum tax each year to protect water quality, as well as nonmaterial support (positive attitude toward environmental causes) increased from 2005 to 2007. A larger percentage of respondents in 2007 expressed the belief that environmental advocacy and education organizations were important to very important. This is especially true of respondents who perceive the conditions of local streams and creeks as being polluted at some level.

Recommendations

In sum, the results from comparative analyses of the 2005 and 2007 survey data as well as an analysis of the 2007 data by number of outreach messages seen or heard, awareness of the issues before exposure to outreach messages, and environmental behavior changes by respondents strongly suggest the EOP was successful in improving environmental awareness, knowledge, and behavior and in heightening the saliency of water quality issues due to run-off pollution in Chico, CA. Future EOP efforts should continue to offer a multi-faceted, multi-media campaign designed to not only heighten the salience of run-off pollution issues, but to provide practical Best Management Practices information to the public. It is important that the terminology be made as clear and consistent as possible to reduce the ambiguity and complexity involved in run-off pollution issues. In addition, future EOP should provide low-cost options for privately as well as publicly adapting and addressing common sources of run-off pollution.