

# Residential Stormwater Retrofit Program

## City of Bellingham

### FY08- SW08052

January 31, 2008 – June 30, 2011

Final Total Project Cost: \$252,712

Final Ecology Grant Contribution: \$189,534

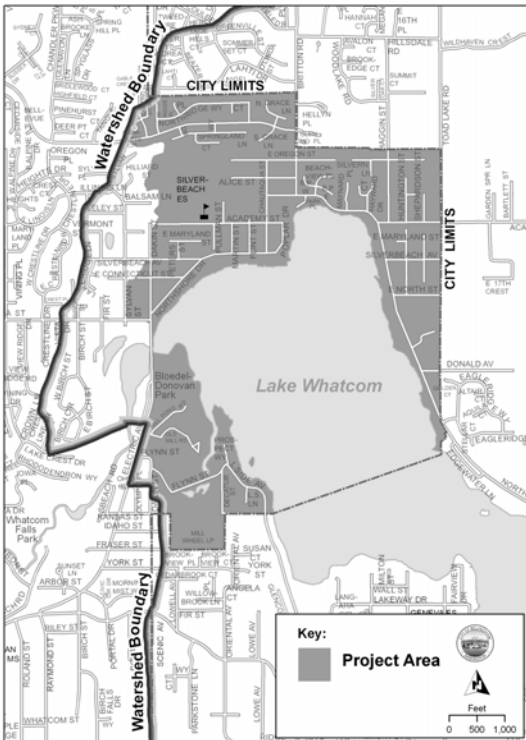
### Project Description

Rain barrels help to slow rainwater as it travels from a roof, through gutters and downspouts, onto impervious surfaces and into Lake Whatcom. The rain barrels serve many functions: reducing pollution, preventing streambed erosion, and regulating water temperature. Working together, these functions improve the water quality and mitigate for some of the impacts caused by development in urban watersheds. In addition, using collected rainwater is better for the environment and conserves treated drinking water. The Residential Stormwater Retrofit Program provided free 95-gallon rain barrels, project design, installation, and inspection to residential homeowners located in the project area. In exchange for this, homeowners participated in a stormwater education workshop.



95-gallon rain barrel

### Residential Stormwater Retrofit Program



Map area of potential eligible participants.

### Project Accomplishments

Detaining Rainwater in the Lake Whatcom Watershed...

- Reduces peak flows, limits erosion, & regulates water temperature
- Increases the efficiency of “end-of-pipe” treatment facilities
- Lowers maintenance cost of public stormwater treatment facilities
  - Reduces overflow events from these facilities
  - Extends the lifetime of these facilities

A total of 166 residential homes participated in the RSRP with 330, 95-gallon rain barrels installed. Of these, 136 homes were located within the designated project area within the Lake Whatcom Watershed with 267 barrels installed. Approximately 3.9 million gallons of stormwater per year is diverted from direct discharge into the infrastructure and is made available to be infiltrated or dispersed on-site. The average participating Lake Whatcom home was able to capture 42% of roof runoff into and through rain barrels. This project captures rainwater from approximately 8% of all available roof area within the City’s portion of the Lake Whatcom Watershed.

## Water Quality Improvements

Specific to Lake Whatcom, which is impaired by nutrient runoff, rain barrels help to lessen the impact of peak flows on treatment systems designed to protect Lake Whatcom. Typically, residential roof water is piped into the same system as runoff from roads and driveways. At the end of the system, before the water enters the Lake, the City has installed expensive treatment facilities to remove pollutants. These filters can be overwhelmed in large storm events, causing untreated water to enter the Lake. In addition these facilities must be maintained at an expense to the public. For each gallon of relatively clean roof water diverted and stored in rain barrels, more dirty water can be filtered and the long-term cost of filtration is reduced.

Decomposing leaf litter in gutters can produce Soluble Reactive Phosphorus (SRP) which, in the absence of rain barrels, has a direct pathway to the Lake through roof drain piping. Diverting this water through rain barrels and into landscaped areas, where SRP can be recycled into the soil, directly reduces the nutrient content in stormwater runoff.

## The Next Step for Continued Success

The City will continue to work with citizens in provision of rain barrels for at minimum water conservation efforts. Installations within the Lake Whatcom Watershed will be provided information on how to use rain barrels in the winter to aid in the dispersion of rainwater and prevent runoff. In addition, homeowners in the Lake Whatcom Watershed who have interest in rainwater harvesting can utilize the Homeowner Incentive Program (HIP), launched in 2011, to purchase, install, and use cisterns as Low Impact Development (LID) retrofits.

## Lessons Learned

The issues surrounding a local government conducting public works projects on private property posed some challenges in determining appropriate contract language and protocol, and comfort level of participants entering into such an agreement. Another lesson learned was that even after soliciting and obtaining resident input prior to the City purchasing a rain barrel for the project, selecting one size doesn't necessarily fit all aesthetic preferences nor allow for effective installation at all properties. In addition to color and design of rain barrels, capacity of them was also subjective to participants.

### Recipient Contact Information

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## **I. OVERVIEW DESCRIPTION OF PROJECT**

The Lake Whatcom Watershed is the primary drinking water source to nearly 100,000 people in Whatcom County, including the 94,000 served by the City of Bellingham. For several decades, Lake Whatcom's water quality has been deteriorating as a result of phosphorus entering the lake from residential development, forest practices, natural processes and other sources. This phosphorus loading has resulted in widespread algal blooms and dissolved oxygen deficits. In 1998, Lake Whatcom water quality failed to meet state dissolved oxygen standards and was placed on Washington's 303(d) list of polluted waters.

The City of Bellingham, in joint partnership with Whatcom County, Lake Whatcom Water & Sewer District and Department of Ecology has been applying structural and non-structural Best Management Practices (BMP's) to Lake Whatcom for 15+ years. The Residential Stormwater Retrofit Project (RSRP) was designed to continue the City's efforts in applying structural BMP's to all existing development within the City's jurisdiction of the Lake Whatcom Watershed.

Retrofitting homes with rain barrels will help detain stormwater flows and slowly release the water from the collection system back into the soil for infiltration. Managing rainwater to prevent runoff starts by capturing and infiltrating the water where it falls, mimicking the natural forested condition. This system helps reduce stormwater from travelling offsite and potential transport of phosphorus and other pollutants into the Lake Whatcom Watershed and other local water bodies.

Approximately 1,000 homes in the Lake Whatcom Watershed are located within city-limits. The RSRP was designed to target these homes for installation of rain barrels to aid in the reduction of stormwater runoff and protection of water quality in the Lake Whatcom Watershed. The project was also targeted to approximately 500 homes in the city whose downspouts have been identified as being connected to the City's sanitary sewer system (Infiltration and Inflow, or "I & I" residences). Approximately 3 million gallons of stormwater per day from these homes is routed to the wastewater treatment plant instead of the existing stormwater system or on-site infiltration. Installing rain barrels to these homes would remove stormwater from the City's sanitary sewer system and meet the expectations of the Phase II NPDES permit.

**II. OUTCOME**

The goal of the Residential Stormwater Retrofit Program (RSRP) was to retrofit 300 homes with rain barrels over the three-year project period. As part of the program, the project provided a free feasibility evaluation, free project design, up to three free 95-gallon rain barrels per eligible residence, free installation of rain barrels, and free project inspection. In exchange for the above, the homeowner’s obligation was to verify property ownership, sign a liability waiver, attend a stormwater education workshop provided by the City, perform minimal maintenance on the installed rain barrels for continued functionality, and authorize data collection by City staff during project period.

The City had a rain barrel program in place for approximately 4 years prior to application submittal to the Department of Ecology’s Stormwater Implementation Grant program. Public interest and purchase of rain barrels was increasing each year through the City’s workshops and assisted in providing a foundation for planning the Residential Stormwater Retrofit Program.

The following tasks and associated activities were carried out by City staff over the 3-year project period:

*Task 1 – Project Administration/Management*

Activities in this task included coordination of project development, organization, and deliverables, preparation and submission of quarterly progress reports, purchase and acquisition of project materials, quarterly staff meetings (monthly for first year of project), and annual meetings with the regional project manager.

Required Performance:

TASK 1	% COMPLETE	Notes
A. Effective administration and management of grant project.	100%	
B. Maintenance of all project records.	100%	
C. Submittal of all required performance items, including the Post Project Assessment Plan, progress reports, financial vouchers, and maintenance of all project records.	100%	

*Task 2 – Public Involvement, Education and Community Outreach*

Activities for Task 2 varied over the three year period and included the following:

**Focus Groups-** The City contracted with a social marketing firm, Applied Research Northwest, to convene two focus groups to determine barriers and benefits to participation in the RSRP and guide project implementation. Specifically, staff wanted to determine the following:

- Residents' awareness of stormwater issues in the project area
- How project area homeowners would respond to rain barrels as a solution to stormwater problems (effectiveness, alternatives, cost etc.)
- Potential objections to rain barrels as a solution and desire to have a rain barrel installed on their property
- Perceived benefits for using rain barrels personally and as a community
- Messages that depict issues that resonate with their sense of identity and community

Social marketing strategies for outreach use focus group findings to determine how to encourage certain behaviors, attitudes, and awareness and determine barriers and benefits to program participation. Using the findings below from the focus groups conducted (two focus groups with nine and ten participants respectively), staff designed and developed an outreach and marketing campaign to kick-off the program. Focus group participants suggested the following:

- Reminders about rain barrel maintenance in a newsletter or as an in-service training, or a calendar with reminder dates and contact information.
- Make participation in the program simple, easy and convenient. Arrange training at a location in or near the Silver Beach Neighborhood, such as Bloedel-Donovan Pavilion in the evening and provide child care or a concurrent workshop for kids about stormwater conservation.
- Provide clear, detailed information that dispels misconceptions about the effectiveness of rain barrels to reduce stormwater pollution and detailed information about the ease of operation and maintenance.
- Emphasize the availability of technical assistance to reduce concerns about operation and maintenance as well as the option to paint rain barrels to reduce concerns about aesthetics.
- As a first step for recruitment, enroll some residents who are active in conservation and receptive to the rain barrel program. This could include residents with a rain barrel who would like another one. These could also include residents who need technical assistance with rain barrels they already have. This can help start word-of-mouth advertising.
- A number of organizations should or could be involved with delivering messages about the program and program involvement, perhaps as a venue host. The neighborhood elementary school and the Silver Beach Neighborhood Association

should somehow be involved and as well as the Public Market and WSU Extension Master Gardener program. Other suggestions about organizations to involve in messaging were the Western Washington University (perhaps recruit volunteer students), The Garden Spot, Bakerview Nursery, the Coop, and a neighborhood church.

While participants did not articulate examples of messages that would resonate with them, they talked about what benefits appealed to them about rain barrels. Strong outreach messages will emphasize these benefits: free rain barrel installation, free training, reminders and technical assistance for maintenance. Several participants said it would be interesting to them if rain barrels were locally manufactured. Focus group participants said spring would be the best time of year to promote the rain barrels and to hold training workshops. Participants suggested setting up a demonstration rain barrel at a central location like Silver Beach General Market or Bloedel Donovan Park.

The Core Product (free rain barrel installation, training, reminders about maintenance) was the most compelling to the target audience, so staff felt it would be strategic to emphasize these aspects of the program more prominently in outreach messages. The rain barrel became a visual reminder about the importance of conservation and protection of the City of Bellingham's water supply. It also became a connector of neighbors and neighborhood, and provided participants a sense of doing one's part.

**Presentations-** Information and recruitment for the RSRP were conducted at a total of 4 associated neighborhood meetings throughout the project period. Project staff was also selected to present the RSRP at the 2009 American Rainwater Catchment Systems Association (ARCSA) national conference in Athens, Georgia.

**Advertising-** Based on the focus group feedback presented above, marketing and outreach for the project was conducted in various formats over the duration of the project period and included the following:

- dedicated project webpage on the city's website
- information mailers (mailed to 750 to Lake Whatcom Watershed residents, 597 I&I residents)
- flyers at Silver Beach Elementary School (distributed to 400 students)
- doorhangers (650 distributed by City staff)
- installed rain barrel on display complete with signage at Bloedel Donovan Park
- television ad
- yard signs (placed in front yards of 20 participating homeowners)
- letters to new residential homeowners within project area (33) as well as newly identified I&I residences (119)

**Workshops-** As part of the project agreement, City staff developed and implemented stormwater education workshops to 113 homeowners participating in the project. Scheduling and attendance by project participants proved to be challenging for staff, with several workshops resulting in only a few attendees. In response to this, staff scheduled workshops outside the summertime as much as possible in an attempt to gain greater participation.

Required Performance:

TASK 2	% COMPLETE	Notes
A. Contract with social marketing firm to recruit participants and convene two focus groups.	100%	
B. Using information from focus groups, develop mailer for target audience.	100%	
C. Produce education campaign including newspaper advertising, tours and presentations to neighborhood groups.	100%	
D. Presentations to selected neighborhood groups including Lake Whatcom watershed and areas of high I & I concentration.	100%	
E. Produce 4 minute educational video including rain barrels as stormwater infiltration device and benefits to the community.	100%	
F. Design, administer and analyze pre and post program on-line questionnaire.	100%	
G. Produce BTV 10 segment on rain barrel program (in kind).	100%	As part of #5
H. Share findings through city web page and articles written for local and regional publications.	100%	

*Task 3 – Implementation*

Implementation of the RSRP was carried out by one project team member for installation of the rain barrels and associated drip irrigation systems for the duration of the grant period. Rain barrels were purchased from local manufacturer Cypress Designs, which were 95-gallon capacity and constructed with 100% recycled plastic.

When a resident was interested in the project and confirmed to be located within the project area, staff established the following process for implementation of the program:

- conduct a site evaluation to determine how many rain barrels the participant is eligible to receive,
- draft site plan to confirm barrel location(s),
- prepare contract documents for both homeowner and city signatures,
- install rain barrel(s) per previously confirmed site plan

All project participants received a maintenance manual upon receipt of contract materials that describes how to maintain functionality of the rain barrel. Project documents, data, and records were maintained in an Access database throughout the project period. This information included the square footage of each participating home that drained into the number of rain barrels installed at each site. This data provides estimates on the amount of stormwater that is detained onsite annually at each participating home.

Required Performance:

TASK 3	% COMPLETE	Notes
A. Effective administration and implementation of this project.	100%	
B. Project scheduling of activities.	100%	
C. Contract with Cypress Designs for rain barrel production.	100%	
D. Installation training and installation of rain barrels on participating residences.	100%	
E. Data collection and project records, quarterly progress reports, final report.	100%	

*Task 4 – Follow-up*

Participants received a project completion report when rain barrel(s) installation was complete, informing them of the volume of rainwater managed on their property annually. Additionally, maintenance postcards were mailed out bi-annually (April 1 and October 1) to participants reminding them to close and open the valves on the rain barrels for appropriate seasonal use (eg closed April 1-September 31, open October 1 – March 31). Because many of these barrels are visible from the roadway or visible when working on a neighbors’ rain barrel project, the installer has been periodically viewing installations at sites to detect problems. Additionally, a random sample of 22 participants received inspection of their rain barrels to determine any necessary improvements or maintenance issues. Barrels installed in the fall of 2008 were also inspected between January 8-10, 2009 after an immense storm event spanning January 6-7, 2009 (2.39 inches of rain on 1/6 and 2.63 inches on 1/7). Finally, homeowners who reported issues with rain barrels received inspections resulting from their complaint. Results as of inspections are as follows:

- Barrels inspected directly (including calls for service): 62
- Directly inspected barrels passing: 54
- Directly inspected barrels failing (Service calls): 4 (manufacturing defect [leak] = 4)
- Directly inspected barrels needing maintenance: 4 (damaged end cap for drain line (2), small gap between barrel and foundation (1), broken spigot valve (1))



Barrels inspected indirectly: 120  
 Indirectly inspected barrels passing: 117  
 Indirectly inspected barrels failing: 3 (downspouts were disconnected)  
 Total Barrels Inspected: 182  
 Total Barrels Passing: 171 (94%)  
 Total Barrels Failing or in need of maintenance: 11 (6%)

Required Performance:

TASK 4	% COMPLETE	Notes
A. Post-installation survey.	100%	Provided in Evaluation section.
B. Summary of program to project participants and public in the form of final project report to be made available in both hard copy and on the web.	100%	
C. Annual inspection of systems installed to ensure proper installation, maintenance, and usage.	94%	The City will continue mailing post cards for annually for 3 years.

A total of 166 residential homes participated with 330, 95-gallon rain barrels installed. Of these, 136 homes were located within the designated project area within the Lake Whatcom Watershed with 267 barrels installed, and 30 additional I&I homes participated with at total of 63 barrels installed. In total, 3.25 acres of roof space was diverted into rain barrels through this program. With all rain barrels installed, approximately 3.9 million gallons of stormwater per year is diverted from direct discharge into the infrastructure and is made available to be infiltrated or dispersed on-site. The average participating Lake Whatcom home was able to capture 42% of roof runoff into and through rain barrels. Preliminary modeling calculations indicate that, on average, 24% of this roof water infiltrates in lawns and landscaping, while the remaining 76% is dispersed into landscaped areas (see discussion in evaluation section below). In a one-inch rain event, roughly 83,000 gallons of rainwater are managed by the rain barrels. In the winter, this water is dispersed or infiltrated, whereas in the summer up to 33,000 gallons are available to be stored at any given time.

This project captures rain water from approximately 8% of all available roof area within the City’s portion of the Lake Whatcom Watershed.

Staff did not reach the targeted goal of retrofitting 300 homes by project end due to unanticipated delays in the implementation process as well as reluctance to participation from residents in project area. Despite marketing the program several times over the three-year period and in several different ways to this population, it is unclear what additional incentive is necessary for participation in order to reach this target number. Implementation delays occurred as a result of determining necessary and appropriate contract items for the City to conduct public works

projects on private property. Research conducted by staff turned up no other contract or project examples to follow suit to for execution of the work. Additional time was taken to consult with the city's legal department to establish proper contract documentation and protocol for implementation. This resulted in the following workflow for contracts between the homeowner and the City:

- City of Bellingham drafts contract for scope of work
- Homeowner approval of work through notarized signature of contract
- Departmental approval of homeowner contract via Public Works Director signature
- City Attorney signature
- City Finance Director signature
- Mayor signature
- Contract gets recorded and copies sent to all parties

### III. EVALUATION

The City feels the RSRP was successful in that an exceptionally large volume of stormwater is now managed on-site at residential homes, assisting in pollution-reduction efforts and reductions in flow to the sanitary sewer system. This was achieved with minimal effort required from participating homeowners (eg free installation of rain barrels, minimal maintenance requirements) and still provides a significant benefit to the public and the City in its water resource management.

The project was unsuccessful with respect to the City not achieving its targeted goal of 300 participating homes during the grant period. Project team members feel this is due to the reluctance of homeowners located in the project area that are not interested in having rain barrels on their homes due to aesthetics, it not being necessary, or not utilizing/needing the collected rainwater.

Project staff conducted a mail-in survey to 123 participants in the RSRP located in the Lake Whatcom Watershed project area, of which 47 participants responded for a 38% participation rate. The survey was designed to collect participants' learning, reaction, behavior changes, and overall results of participating in the RSRP.

When asked if the RSRP increased participants' knowledge about particular subjects important to Lake Whatcom, the results showed an increase in knowledge for at least a third of participants. 40% stated that the RSRP increased their knowledge of how impervious and pervious surfaces from traditional residential development contribute to stormwater pollution and phosphorus transport into Lake Whatcom. Of the respondents, 60% reported that participation in the RSRP resulted in an increase in knowledge about Lake Whatcom's status as a polluted water body. 49% had an increase in understanding that the modification of the watershed from forested to urban conditions is the primary cause of water quality decline in the Lake Whatcom Watershed.

Between 82-100% of participants were able to identify exposed soils, pet waste, fertilizer, and soaps/chemical cleaners all as sources of phosphorus.

An overwhelming 98% indicated that participation in the RSRP has prompted them to think more about their habits and how they affect the Lake Whatcom Watershed.

When asked if participants maintain their rain barrel(s) as suggested for winter and summer performance, 91% reported following the City's instructions, and 96% indicate that they use their collected rainwater during the summer months for outdoor watering.

Participants were asked whether or not they have implemented any additional Best Management Practices (BMP's) that help reduce phosphorus pollution in the lake since participating in the

RSRP. Approximately 50% stated they have adopted lake-friendly landscaping/natural yard care practices, with 37% already doing such practices prior to the RSRP. Many participants (30%) that have pets already pick up their pet waste and 49% stated the question does not apply to them, indicating they do not have pets. Sweeping sidewalks and other hard surfaces resulted in a 37% percent increase in adoption by respondents since participation in the RSRP, with 50% already having incorporated this practice. Washing cars at designated car washes or on a lawn using biodegradable phosphorus-free soap resulted in many respondents adopting this practice as a result of the RSRP (51%), with 40% already implementing this BMP. For installation or retrofit of property with pervious pavements, 67% were not implementing this BMP, with 16% stating the BMP does not apply. Nearly 33% indicated they have implemented the installation of a rain garden or other bio-retention feature, with a 60% 'no' response.

Overwhelmingly, 100% of respondents indicated that participation in the RSRP makes them feel like they are helping to improve water quality of the Lake Whatcom Watershed. Similarly, 87% responded that the RSRP was a good use of grant funding, and 85% have either recommended or will recommend the RSRP to others.

From comments gathered and feedback from the survey, project staff found that assistance from marketing the program came from homeowners who were pleased with having a designated staff member work directly with them on obtaining information about the program, as well as receiving direct stormwater education information on the Lake Whatcom Watershed. This was reflected in the positive comments shared by participants about working with the rain barrel installer. The one-on-one approach with homeowners resulted in participants sharing the program information with other neighbors within the project area.

The rain barrels provide two important functions: first as a stormwater management tool detaining water to then infiltrate and disperse of onsite, and second as a water conservation technique in providing an additional source of water for outdoor watering needs during peak demand periods. The rain barrels assist in both water quality as well as water quantity protection, helping to reduce water pollution and the use of potable water.

Through stormwater modeling it has been determined that 24.3% of the 119,144ft<sup>2</sup> (2.735ac) of impervious surface dispersed in the Lake Whatcom Watershed was infiltrated. This equates to 28,951ft<sup>2</sup> of area infiltrated with a resultant annual phosphorus reduction of .87 lbs based on 1.31lbs/ac/yr. This is a conservative number based on dispersion through a “C” soil lawn area.

The remaining 23,026 square feet of roof (0.529 ac) was removed from the sanitary sewer through I & I installations. This would account for 573,808 gallons each year diverted from the sewer and discharged into landscaping. In a rain event, storm flows to the sewage treatment plant would be reduced by 14,345 gallons per inch of rain.

#### **IV. FOLLOW-UP**

The City has 12 rain barrels left that have been approved for utilization after the end of the grant. These barrels will be installed on properties using City resources for the installations. The barrels being installed to meet the same requirements as specified in the grant. The City will for three years continue to provide information to owners on the proper maintenance and operation of their rain barrels.

The City will continue to work with citizens in provision of rain barrels for at minimum water conservation efforts. Installations within the Lake Whatcom Watershed will be provided information on how to use rain barrels in the winter to aid in the dispersion of rainwater and prevent runoff. In addition, homeowners in the Lake Whatcom Watershed who have interest in rainwater harvesting can utilize the Homeowner Incentive Program (HIP), launched in 2011, to purchase, install, and use cisterns as Low Impact Development (LID) retrofits. The purchase and installation of these cisterns will be reimbursable under the HIP.

While we believe this project has done a share of the work necessary to reduce urban impacts to the Watershed, much more is necessary. While this program only applied to the area of the Lake Whatcom Watershed associated with the City, it acted as a catalyst for action both in the City and County portions of the Watershed. The TMDL for Lake Whatcom is a daunting issue that will only be resolved through many more actions like this grant. The City of Bellingham deeply appreciates the Department of Ecology in aiding this process.

The City had intended to have approximately 150 rain barrels purchased under the grant for use after the closing date. Those barrels would have been installed following the same parameters and process used during the grant and installation would have been funded by the City’s Storm and Surface Water Utility. Unfortunately, the number of barrels manufactured was diminished due to an inability of the manufacturer to supply the barrels as needed. This was the result of time constraints, economic conditions, and delays in the procurement of raw materials. We instead will have only 12 additional barrels available for installation. These barrels will be installed as indicated above and will be included in statistics reported under the three year post survey.

The City will provide information on operation and maintenance of the rain barrel systems for a minimum of three years from the close of the grant. The City will provide the 3 year follow up report for Ecology by June 30, 2014.