

Green-Duwamish CWMA

Priority Knotweed Control



2005 Report to the Stakeholders



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Project Location and Objectives

The Green/Duwamish Watershed Cooperative Weed Management Area (CWMA) was established in September 2003 in response to the impacts of invasive knotweeds (*Polygonum cuspidatum*, *P. sachalinense*, *P. bohemicum*) along the mainstem of the Green River and its major tributaries. The entire Green/Duwamish watershed (Water Resource Inventory Area 9 or WRIA 9) covers an area of 556 square miles with the mainstem Green/Duwamish River consisting of 93 river miles. The Green/Duwamish CWMA's objective is to develop a coordinated approach to controlling invasive knotweeds in the Green/Duwamish watershed.

In 2004 and 2005, the Green/Duwamish CWMA received funding from the USDA Forest Service and the Washington State Department of Agriculture to continue the coordinated knotweed control project in the watershed (Table 1). Invasive knotweeds are highly invasive plants that are presenting an enormous challenge to land managers and restoration groups. Priority actions funded by this project included survey work to determine the extent of knotweed in the watershed, community education and outreach, and continued rapid response control by work crews and volunteers on identified high priority infestations.

Table 1. 2005 Green/Duwamish CWMA Budget					
	Category				
Funding Sources	Survey/Control/ Monitor	Equipment/ supplies	Contractual	Other	Total
USDA- Forest Service	\$7,605.00	\$5,974.90	\$14,294.19		\$27,874.09
Washington State Department of Agriculture	\$4,305.00	\$1,683.42	\$2,335.00		\$8,323.42
King County Noxious Weed Control Program	\$17,295.00		\$6,000.00	\$5,520.00	\$28,815.00
CWMA Partners	\$2,070.00		\$6,332.15		\$8,402.15
Total dollars spent per category	\$31,275.00	\$7,658.32	\$28,961.34	\$5,520.00	\$73,414.66

In particular, control efforts were made to halt invasions of this weed within riparian areas of the middle and upper watershed which are resulting in displacement of native riparian vegetation and impaired riparian ecosystem functioning. Overall project success will aid in protecting critical spawning habitat for several salmonid species including the threatened Puget Sound Chinook. Invasive knotweeds are less widely distributed in the Green/Duwamish watershed than in neighboring watersheds and therefore the benefits from early detection and control are commensurately higher.

King County Noxious Weed Control Program (KCNWCP) as the lead entity for the Green/Duwamish watershed CWMA was responsible for developing the scope for the invasive knotweed control project, expanding on accomplishments made in 2004, and continuing surveys and rapid response control. Tacoma Public Utilities, King County Parks, Washington State Parks, WDFW, King County Roads Division and private landowners continued to provide support for this watershed-based knotweed control concept in 2005, and indicated they would be willing to contribute to matching requirements of any grant monies the CWMA may receive.

Project Site Description

Looking at historic knotweed distribution data collected by KCNWCP and input from CWMA partners, the Upper and Middle Green River subwatersheds were identified as the priority area for continued knotweed control in 2005.



Knotweed infestations in the Upper Green River subwatershed were identified as the highest priority where degradation of mixed deciduous and coniferous riparian stands would be most significant. The dominant land use in the Upper Green subwatershed is forestry with large checker-board stands of intact native plant communities (99% of subwatershed area). The Upper Green River includes the Howard Hanson Reservoir which is managed by Tacoma Public Utilities as the City of Tacoma's water supply. Information provided by Tacoma Public Utilities in 2004

indicated there was one 10,000 sq ft knotweed infestation at an old homestead (Koss Homestead) at River Mile 70 within 250 feet of the reservoir. In early 2005, Tacoma Public Utilities identified a second knotweed infestation located at a second homestead site near Lester, at River Mile 84. The Lester site, located approximately .2 miles from the Green River, and the Koss Homestead site were both designated as high priority sites within the project area.

The Howard Hanson and the Headworks dams physically separate the Upper Green from the Middle Green subwatersheds reducing the risk of knotweed fragments moving downstream along the river corridor. However, there are many roads, railroads, and utility lines which connect the subwatersheds where knotweed could spread by road grading, mowing, or other maintenance activities. The Middle Green subwatershed is significantly infested with invasive knotweed along roadsides and managed lands in upland areas.

Soos Creek, which feeds into the Green River at River Mile 32.5, is significantly infested with knotweed for the first 1.2 miles. The two main public landowners within this segment of the creek are King County Parks and Washington Department of Fish and Wildlife (WDFW), which operates a salmon hatchery. The first six mile section of Soos Creek contains zones of intact riparian vegetation supporting native deciduous trees. Since 1999, Hatchery Natural Area Park, which is managed by King County, has been the focus of intensive restoration and has been planted with native trees and shrubs. Mirafi geo-textile fabric has been used to suppress invasive knotweed and reed canarygrass (*Phalaris arundinacea*) every summer since 2001. Where the fabric has been well secured and the edges have several inches of overlap, the suppression of knotweed has been good. However, in many locations the knotweed is pushing through the fabric and growing along the perimeter of the covered areas. Meetings in June 2004 with King County Parks and WDFW indicated strong support and recognition that any external funding acquired by the CWMA would complement and enhance the existing restoration efforts.

Survey Methods and Results

Extensive surveys in the Green/Duwamish watershed began in early June 2005 to identify priority infestations for control/eradication (Table 2). KCNWCP surveyed 16.5 non-contiguous miles of the mainstem riparian corridor of the Green River from the Tacoma Public Utilities Lester site to Auburn Narrows Park, downstream from the Soos Creek confluence (River Mile 84 to 31.5). Surveys along the Middle Green were conducted by roadside inspections, streamwalking and river rafting. An intensive river rafting survey was conducted from Flaming Geyser State Park to the confluence of Soos Creek (RM 43.5 to 32.5), which identified six priority knotweed infestations along the mainstem of the Green River.

In early June 2005, KCNWCP staff surveyed the knotweed infestations in the Upper Green subwatershed. The Koss Homestead site showed approximately 5% regrowth from control efforts in 2004 and was treated with a foliar application of Aquamaster and the surfactant Agridex at the time of survey. In July 2005, the new knotweed site at Lester was injected with Glypro, an aquatic formulation of glyphosate.



Along the mainstem of the Middle Green River, 14 knotweed infestations, including the six identified during the river rafting survey, were selected for treatment because of their location within 200 feet of the river, or because they were on a roadside ditch that had a hydrological connection to the river. Three additional sites in the Middle Green subwatershed were identified as priority sites due to their high visibility and proximity (within 600 feet) to the river. In addition to the mainstem, 7 sites along Soos Creek and 4 sites along Crisp Creek were selected for treatment. Twenty-two upland and roadside knotweed sites surveyed in 2004 that were located over 500 feet from a minor tributary were not selected as priority sites in 2005 but may be selected for control in 2006.

Data was collected at each site with GPS units and included the knotweed species, growth stage of knotweed, area infested, percent cover of infestation, habitat type, proximity to riparian corridor and condition of knotweed. Recommendations for treatment methods were also provided based on site conditions. An infestation or a site is defined as a parcel, or in the case of large publicly owned lands, distinct locations within a parcel separated by a barrier (road, stream), differences in land-use, or 0.5 mile distance. Within each site or infestation, there may be many discreet patches of knotweed which may change over time. The area of an infestation is defined either as the “gross area” referring to the total area of knotweed infested land or the “cumulative area” which is the sum of the area of the knotweed patches.

Table 2. Green/Duwamish Watershed CWMA 2005 Survey Results by Sub-watershed

Stream Name	Miles Surveyed	Number of Sites	Priority Sites 2005	Survey Method
Upper Green River	1	3	3	Site visit, road side surveys
Middle Green River	15.5	39 (22 from 2004)	17	River rafting, road surveys, streamwalking
Crisp Creek	0.5	4	4	Streamwalking
Soos Creek	1.5	7	7	Streamwalking
Total	18.5	53	31	

Knotweed Control Action Plan

Evaluating site conditions and risk issues such as land-use, proximity to water, exposure of herbicide to the public, risk of collateral damage to native vegetation, and percentage of regrowth from sites treated in 2004 was necessary to determine the preferred treatment option on a site by site basis. Knotweed stem injection with glyphosate was selected as the primary treatment option for sites directly adjacent to riparian corridors and foliar applications of aquatic herbicides was chosen for all other infestations. Knotweed infestations exceeding 10,000 sq ft and located in upland areas was mowed and regrowth was either foliarly treated with an aquatic herbicide or sheet mulched with geo-textile fabric.



Earthcorps and Washington Conservation Corps (WCC) were hired to perform the majority of the stem injection work and Woodland Resources Inc. was hired to carry out foliar treatments. King County Roads Division also performed foliar treatments for priority knotweed infestations along the road rights-of-way.

Two National Pollutant Discharge Elimination System (NPDES) permits were acquired for the priority knotweed control

area to ensure compliance with Federal Clean Water Act requirements. The first permit was acquired on June 7, 2005 for the use of glyphosate, and the second on September 19, 2005, for the use of imazapyr.

Implementation of Action Plan

Once the priority control sites were identified, KCNWCP began contacting private landowners along the mainstem of the Green River, Soos Creek, and Crisp Creek to seek their support and consent for knotweed treatment on their property. All 13 private property owners contacted agreed with the goals of the CWMA and responded to KCNWCP's request for consent in time to have the knotweed on their properties controlled in 2005.

KCNWCP provided training for knotweed stem injection on July 18th and August 9th for contractor crews. Crew leaders were then responsible for any subsequent staff trainings and KCNWCP provided quality control and assurance as well as site orientation and logistics.

The methodology for knotweed stem injection was to inject each cane between the lowest two nodes using a 3 ml dose of undiluted Glypro, an aquatic formulation of glyphosate as recommended by the manufacturer of the stem injector. The amount of herbicide injected directly into the knotweed canes was reduced from the 5 ml dose used in 2004 to 3 ml per cane. This decision was based on research developed by Washington State University and The Nature Conservancy. After injection, each cane was marked with either degradable survey paint or a marking stick to help the applicator distinguish treated versus untreated canes. The crews reported mixed feelings on using the survey paint over the marking sticks. Although the survey paint is irritating to breathe, some crew members preferred it over the marking sticks because it was more visible.

Stem injection is a labor-intensive control method but the low risk of drift, mobility into groundwater, and collateral damage made it the preferred method on sites directly adjacent to river corridors. Foliar treatments of the aquatic formulation of glyphosate were applied by backpack sprayer at a rate of 2.5 oz per gallon of solution with 1oz per gallon of the surfactant Agridex. In addition, Woodland Resources applied Renovate, the aquatic formulation of triclopyr, with the surfactant DyneAmic to infestations that were not immediately adjacent to waterways. The threshold for treatment was 80% control of all knotweed stems on site and 90% control on all stems that could be injected with a 3 ml dose.



Nineteen days comprising 1,112 hours were provided by Earthcorps and WCC for knotweed control in the project area. Two days/120 hours was dedicated to brush cutting, 2.5 days/150 hours was dedicated to foliar spray applications and 14.5 days/842 hours was dedicated to stem injection. As part of the in-kind match, King County Stewardship Section hired Earthcorps in late July 2005 to brush-cut and cover a 15,000 sq ft knotweed patch at Hatchery Park with Mirafi geo-textile material. Woodland Resources Inc. was hired to spray the perimeter of this patch. Woodland Resources Inc. provided 40 hours over four days of foliar treatment in July, August, and September 2005. KCNWCP staff also performed 99.5 hours of stem injection and foliar spraying over 3 days. The majority of contractor time was used to stem inject knotweed along Soos Creek, using 13.5 of the 19 contractor days scheduled.

Knotweed Control Results

The last day of control was conducted on September 27, 2005, and effects are just beginning to show at the time this report is being written. Site conditions encountered in 2005 required shifting control techniques from exclusively stem injection to more foliar treatments. Site monitoring revealed that the knotweed mortality rates were much lower than expected. Three sites monitored to date, all of which were controlled exclusively by foliar application in 2005, are showing only 75% mortality rate on average. These particular sites were injected in 2004 and the regrowth in 2005 was not suitable for injection. The plants at the time of monitoring were stunted and the leaves were curling, showing damage from herbicide uptake, however, they still appear to be viable. We are still evaluating treated sites at this time and overall mortality rates will be further assessed in the spring of 2006.



Area known as SE 310th; left photo taken September 2004 shortly after stem injection treatment. Right photo taken early June 2005 shows no regrowth.

Some highlights from the 2005 knotweed treatments are described below:

The 10,000 sq ft knotweed infestation in the Upper Green subwatershed controlled by stem injection in 2004 had 3% regrowth rates in 2005. This regrowth was sprayed using an 8 oz per gallon solution of Aquamaster with 1 oz per gallon of the surfactant Agridex. The 2000 sq ft knotweed infestation located near River Mile 84 was injected with a 3 ml per cane dose. Tacoma Public Utilities reported 99% control at this injected site.

Of the 31 sites selected for treatment in the Green/Duwamish watershed, control was achieved on 30 sites. Only three of the 30 sites, the Lester site, a site along the Green River near River Mile 35, and a private property on Soos Creek, used injection as the sole method of control. Fifteen sites were controlled using the foliar method exclusively, and the remaining 11 used a combination of methods. In total, 8.96 net acres of invasive knotweed was treated in 2005 within 23.3 gross infested acres.

A majority of the priority sites are owned by government agencies. Table 2 below summarizes the results of knotweed treatment by property owner describing the gross infested area treated and the cumulative area of knotweed. The percent mortality is not known at this time as data is currently being collected.

Table 3. Invasive Knotweed Species Control along Mainstem Upper and Middle Green River in 2005*

Ownership	Gross Knotweed Infested Area Treated in 2005 ¹ (sq ft)	Cumulative Knotweed Area Infested in 2005 ² (sq ft)	Cumulative Knotweed Area Treated in 2005 ³ (sq ft)
King County	383,209	222,822	222,822
Washington State Parks	82,568	9,544	9,544
Washington State Department of Fish & Wildlife	220,931	52,232	52,232
Washington State Department of Natural Resources	60,626	7,080	7,080
Tacoma Public Utilities	23,368	14,699	14,699
Privately Owned Lands	243,037	110,214	83,976
Total (sq ft)	1,013,739	416,591	390,353
Total	23.3	9.6	8.96

* Locations treated occur within Green River riparian zone or adjacent to streams which are hydrologically connected to the Green River

1 Extent of infested land treated in landscape

2 Aggregate of individual patches selected for treatment in landscape

3 Aggregate of individual patches treated in landscape

Discussion

The 2005 control strategy for invasive knotweed changed from the strategy used in 2004. The re-growth from sites injected in 2004 was significantly less robust and unsuitable for injection. As a result, use of foliar applications was increased in 2005, resulting in more net acreage of knotweed controlled in 2005. Changes to be proposed for the Green/Duwamish CWMA objectives in 2006 will be largely dependant upon information collected from monitoring controlled sites in the spring of 2006. The preventative strategy used in 2004 and 2005, working from the furthest upstream infestations down along the river corridor, could be applied to non-riparian infestations within the Upper and Middle Green River subwatersheds. These infestations, while not a significant short-term risk to the river mainstem or tributaries, do present a longer term threat as knotweed fragments are moved within the watershed by road maintenance activities and other forms of disturbance.

Successful control of knotweed in the current project area may also allow for an expanded knotweed control effort in the Lower Green subwatershed. This subwatershed is heavily impacted by commercial and urban residential land use and has limited functional riparian habitat. However, there are scattered parks and greenspaces that would benefit from knotweed removal and as a preventative measure it would be useful to create a buffer area excluding knotweed from returning to the Middle or Upper Green River. The City of Auburn has been a supporter of the CWMA concept since our initial scoping meeting in September 2003 and with continued funding, the Green/Duwamish CWMA would likely extend downstream an additional seven miles to river mile 25 at North Green River Park.

Conclusion

The 2005 Green/Duwamish CWMA priority knotweed control project achieved another successful season that will continue to provide substantial long-term environmental benefits to the Green/Duwamish riparian ecosystem. The watershed was extensively surveyed and an action plan defined 31 high priority infestations totaling 9.6 net acres for control. To be effective over time, this project needs to continue as part of a long term strategic knotweed control program. A significant outcome of the project has been the development of the capacity of the CWMA to implement this long-term strategy.



Area known as Neely Mansion. Above left photo taken before control work in 2005. Above right photo taken after control work.



Left: Brush cutting begins in July, 2005, on a large stand of knotweed. Right: Regrowth after brush cutting and foliar application in October 2005.