

# Green River CWMA Invasive Knotweed Control



## 2006 Report



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## **Project Summary**

The Green/Duwamish Cooperative Weed Management Area (CWMA) Invasive Knotweed Control Project was established in September 2003 in response to the impacts of invasive knotweeds (*Polygonum cuspidatum*, *P. sachalinense*, *P. X bohemicum*) along the mainstem of the Green River and its major tributaries. In 2006, all known infestations of invasive knotweed in riparian zones of the project area (a total of 6.68 net acres) were treated and controlled. Knotweed vigor and impacts have been significantly reduced in the project area and no longer impair ecological functioning of these riparian ecosystems. After three consecutive years control efforts, the project is entering the maintenance phase which could allow for expansion of the project area onto sites further from the Green River, or elsewhere in the watershed.

## **Project Location and Objectives**

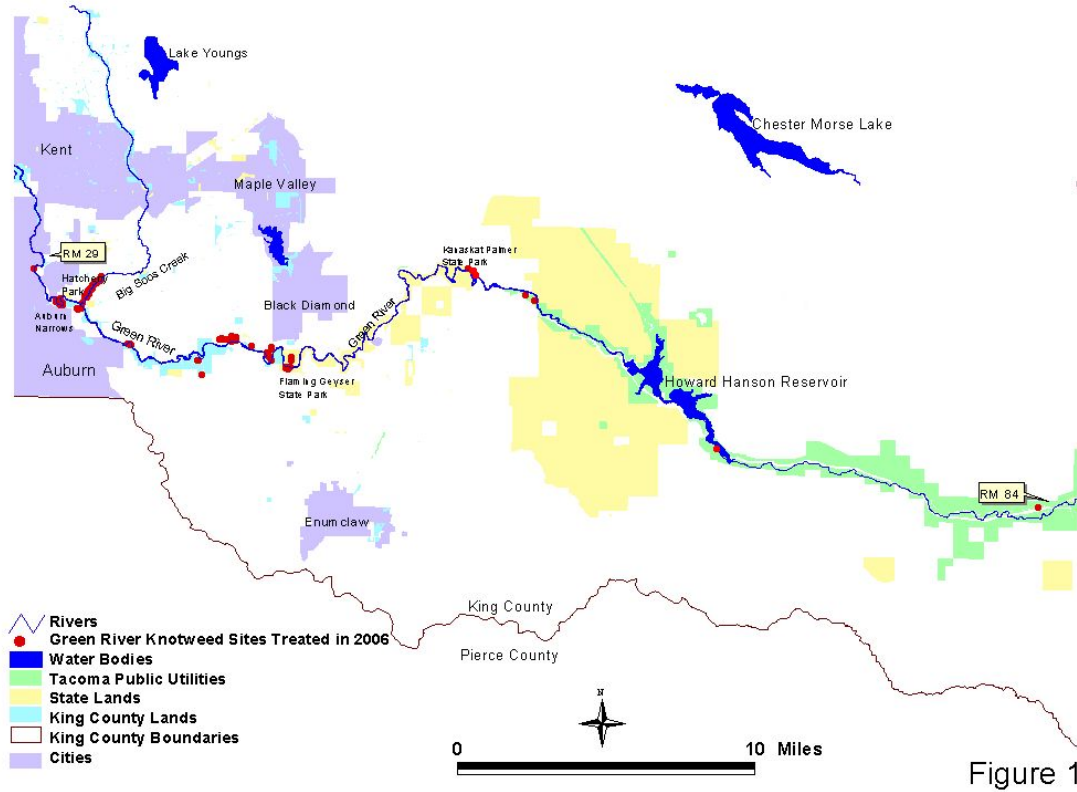
The Green/Duwamish CWMA project is located along the Green River and its major tributaries in Water Resource Inventory Area (WRIA) 9, King County Washington (Figure 1). The Green/Duwamish CWMA Invasive Knotweed Control Project's objectives were to develop a coordinated approach for controlling invasive knotweeds in the watershed and carry out control efforts on a landscape scale.

The mainstem Green/Duwamish River consists of 93 river miles, and the quality of the riparian zone varies with the surrounding land use, from high quality mixed deciduous and conifer forest to cleared agricultural and industrial lands. The entire Green/Duwamish watershed (WRIA 9) covers an area of 556 square miles. Large stretches in the Upper (67%) and Middle (53%) Green River subwatersheds have riparian zones that are intact and support vegetation similar to the original native plant communities. However, according to National Marine Fisheries Service (NMFS) criteria for riparian function, with the exception of the Green River gorge, riparian zones in the Middle Green are currently not functioning properly because most are too narrow or support primarily non-native vegetation (King County, 2001). Additionally, due to the small size of existing riparian trees and truncated riparian zone width, almost 30% of the channel length in the Middle Green is currently classified as providing a poor level of shade, with 27% rated poor in the ability to supply organic matter and filter sediments. Yet this same Middle Green subwatershed is the stretch in which most mainstem salmonid spawning occurs. This habitat degradation can be mitigated by eliminating rhizomatous riparian noxious weeds such as invasive knotweed, which will prevent further degradation and begin to restore riparian forests and the healthy functioning of these areas.

In 2004, 2005 and 2006, the Green/Duwamish CWMA received funding from the USDA - Forest Service (USDA-FS) to coordinate knotweed control projects in the watershed. Non-native 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 monitor knotweed distribution in the watershed,

community education and outreach, and undertake continued rapid response control by work crews and volunteers on identified high priority infestations.

### Green/Duwamish CWMA Invasive Knotweed Control Project



In particular, control efforts were made to halt invasions of knotweeds that are displacing native riparian vegetation and impairing riparian ecosystem functions in the middle and upper watersheds. Project success in the Green/Duwamish watershed 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 upper areas of the Green River, 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 CWMA was responsible for developing the scope for the invasive knotweed control project, expanding on accomplishments made in 2004 and 2005, and continuing surveys and rapid response control. Tacoma Public Utilities (TPU), King County Parks, Washington State Parks, U.S. Fish and Wildlife Service (USFWS), King County Roads Division and private landowners continued to provide support for this watershed-based knotweed control effort in 2006.

## 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 2006.

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 stands of intact native plant communities (99% of subwatershed area). The Upper Green River includes the Howard Hanson Reservoir which is managed by TPU as the City of Tacoma's water supply. Information provided by TPU in 2004 indicated there was one 10,000 square foot knotweed infestation at an old homestead (Koss Homestead) at River Mile 70 within 250 feet of the reservoir. In early 2005, TPU 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 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 one and a half 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 2006 to identify priority infestations for control. The Green/Duwamish CWMA project area encompasses approximately 54.5 river miles (RM) of the mainstem riparian corridor of the Green River from the TPU Lester homestead site to approximately two miles downstream of Auburn Narrows Natural Area (RM 84 to 29.5). Surveys along the Green River were conducted by roadside inspections, streamwalking and river rafting. KCNWCP conducted an intensive river rafting survey along 16.5 river miles of the Green River, from TPU main gate to Flaming Geyser State Park (RM 60 to 43.5). The remaining 38 river miles were spot checked at known sites, road crossings and select properties along the riparian corridor of the Green River. In addition, surveys along one and a half river miles of Soos Creek, from its confluence with the Green River and one-half river mile of Crisp Creek were surveyed (Table 1). Two sites from 2004 and 2005 showed no re-growth in 2006 and are not reflected in Table 1.

| <b>Stream Name</b>             | <b>Number of Sites in 2006 (parcels)*</b> | <b>2006 Priority Sites Controlled (parcels)*</b> | <b>Survey Methods</b>                          |
|--------------------------------|---|--|--|
| Green River (Upper and Middle) | 49  | 27   | River Rafting, Roadside Surveys, Streamwalking |
| Crisp Creek                    | 4   | 4  | Streamwalking                                  |
| Soos Creek                     | 9   | 9  | Roadside Surveys, Streamwalking                |
| <b>Total</b>                   | <b>62</b>                                 | <b>40</b>  |  |

\* Parcels may have more than one knotweed patch/infestation.

In early June 2006, TPU staff surveyed the knotweed infestations in the Upper Green subwatershed. The Koss Homestead site showed approximately 1% re-growth from control efforts in 2004 and 2005 and the Lester site showed a 1% re-growth from 2005 injection. TPU staff took on responsibility for control of their knotweed infestations in 2006 and treated all known sites in their jurisdiction.

Along the mainstem of the Green River, 17 knotweed infestations 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. Ten additional sites in the Green River watershed were identified as priority sites due to their high visibility and proximity (within 600 feet) to the river. In addition to the mainstem of the Green River, nine sites on Soos Creek and four sites on Crisp Creek were selected for treatment. Twenty-two upland and roadside sites surveyed in 2004 that were located over 500 feet from a minor tributary were not selected as priority sites in 2006 but may be selected for control in 2007. All known priority knotweed infestations within the project area were treated 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 discrete 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.

## **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 re-growth from sites treated in 2004 and 2005 was necessary to determine the preferred treatment option on a site by site basis. Knotweed stem injection with the herbicide 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 would be foliarly treated with an aquatic herbicide.

Washington Conservation Corps (WCC) crews were hired to perform the majority of the stem injection and Woodland Resource Services was hired to carry out foliar treatments. KCNWCP staff also performed foliar treatments for priority knotweed infestations in the project area. A National Pollutant Discharge Elimination System (NPDES) permit was acquired for the priority knotweed control area to ensure compliance with Federal Clean Water Act requirements. The permit was acquired on May 12<sup>th</sup> 2006 for the use of the herbicides glyphosate and imazapyr on invasive knotweed infestations.

## **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 nineteen 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 2006.

KCNWCP provided knotweed stem injection training on July 17<sup>th</sup> 2006 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 three milliliter dose of undiluted AquaMaster/AquaNeat (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 five milliliter dose per cane used in 2004 to three milliliters per cane. This decision was based on research developed by Washington State University and

The Nature Conservancy showing three milliliters to be as effective as five milliliters. After injection, each cane was marked with either degradable survey paint or a marking stick to help the applicator distinguish treated versus untreated canes.

Stem injection is a labor-intensive control method but the low risk of drift, mobility in soil, and collateral damage made it the preferred method on sites directly adjacent to water. Foliar treatments were applied by backpack sprayer. Herbicide application rates were 2% glyphosate (AquaMaster/AquaNeat) combined with 1% imazapyr (Habitat), and 1% Agridex (surfactant). The foliar treatment goal was 80% control of all knotweed stems on site and 90% control on all stems that could be injected with a three milliliter dose of glyphosate.

Ten and a half days comprising approximately 507 man-hours were provided by WCC for knotweed control using the stem injection method. Crews were typically made up of six crew members, including the crew supervisor. Woodland Resource Services provided 48.5 hours, over four days, of foliar treatment in July and August 2006. KCNWCP staff performed 154 hours of foliar spraying over six days in August, September and October 2006. WCC spent the entire 10.5 days stem injecting knotweed along Soos Creek in the Green/Duwamish watershed while Woodland Resource Services and KCNWCP staff sprayed sites throughout the project area. Funding for knotweed control work was provided by the U.S. Department of Agriculture – Forest Service, Forest Health Protection (USDA- FS, FHP) and USFWS. One and a half days of WCC crew time on Soos Creek was provided for with USDA-FS, FHP funds and the remaining nine days were provided for under the USFWS grant (pending). Washington State Department of Agriculture (WSDA) provided some herbicide for use on the project.

## **Knotweed Control Results**

Control was achieved on 40 priority sites selected for treatment in the Green/Duwamish CWMA project area. Since the Green/Duwamish CWMA began in 2004, there have been numerous partners that contributed to the efforts to control invasive knotweed infestations. Private property owners account for 47% of the partners and public agencies and municipalities, such as TPU, Washington State Parks, Washington State Department of Natural Resources, Cities of Auburn and Kent, King County Roads and King County Department of Natural Resources and Parks account for the remaining 53%. Table 2 below summarizes the results of knotweed treatment in the Green/Duwamish watershed, describing the gross infested area and the net area of knotweed treated. The percent mortality is not known at this time as data has yet to be collected and analyzed.

**Table 2. Invasive Knotweed Species Control in the Green/Duwamish River Watershed\* in 2006**

| <b>Ownership</b>        | Gross Knotweed Area Infested <sup>1</sup> in 2006 (sq ft) | Net Knotweed Infested Area <sup>2</sup> in 2006 (sq ft) | Net Knotweed Area Treated <sup>3</sup> in 2006 (sq ft) |
|-------------------------|---|---|--|
| King County Lands       | 193,465.3   | 88,650.832  | 88,650.832   |
| Washington State Lands  | 215,665.89  | 66,709.624  | 66,709.624   |
| Tacoma Public Utilities | 6,590.037   | 6,590.037   | 6,590.037  |
| Privately Owned Lands   | 240,536.741   | 129,051.1   | 129,051.1  |
| <b>Total in Sq ft</b>   | 656,257.968   | 291,001.59  | 291,001.59   |
| <b>Total in Acres</b>   | 15.06   | 6.68  | 6.68   |

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

Gross Knotweed Area Infested<sup>1</sup>: Aggregate of infested sites selected for treatment in landscape

Net Knotweed Infested Area<sup>2</sup>: Aggregate of individual patches in landscape

Net Knotweed Area Treated<sup>3</sup>: Aggregate of infested sites treated in landscape

The initial goals of the project were overwhelmingly met in terms of surveys, education and outreach, planning and coordination, recruitment of new CWMA partners, and selecting and treating 40 sites in the project area. Control in the Green/Duwamish watershed amounted to a total of 6.68 net acres of knotweed, within 15.06 gross infested acres.

Sasha Shaw, Noxious Weed Education Specialist, and Monica Walker, Project Manager, conducted three outreach events for landowners, control crews and volunteers in 2006. A six page handout was created detailing knotweed biology and control options, and an on-line knotweed biology and control slide show was created (<http://dnr.metrokc.gov/wlr/lands/weeds/pdf/Knotweed%20Biology%20and%20Control.ppt>).

The last day of control was October 9<sup>th</sup>, 2006 and effects are just beginning to show at this time. Efficacy will be assessed in early spring 2007. Due to the addition of the aquatic herbicide imazapyr to our control efforts, monitoring will begin in spring 2007. All information suggests that monitoring the year following an imazapyr treatment is necessary due to its residual quality.

## **Discussion**

The 2006 control strategy for invasive knotweed did not change from 2005 control strategy. The re-growth from sites injected in 2004 and 2005 was significantly less robust and unsuitable for injection. As a result, use of foliar applications was increased in 2006. Changes to be proposed for the Green/Duwamish CWMA objectives in 2007 will be largely dependant upon information collected from monitoring controlled sites in the spring of 2007. 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.



Transferring responsibility for control of infestations to property owners/land managers is a next important step in this CWMA control strategy. For example, TPU took over control of their four sites in 2006 allowing KCNWCP to focus control efforts in other areas of the watershed. This transference of responsibility will free up resources and allow the project to expand control efforts downstream, or to non-riparian infestations in the watershed.

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 to prevent 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.

Any changes for the Green/Duwamish CWMA project objectives in 2007 will be largely dependent upon information collected from monitoring the 2006 control work and the amount of funding the project receives. Control efforts in 2007 on the Green River will likely include foliar applications of the aquatic herbicides glyphosate and imazapyr. The majority of infestations were injected in 2006 which usually results in the need for foliar treatment of re-growth in subsequent years. In addition, due to the extensive flooding in the fall of 2006, it will be necessary to conduct an intensive river rafting survey in 2007 to determine if there are new infestations along the riparian corridor caused by the movement of rhizomes by the floodwaters.

The preventative strategy used in 2006 (top-down control) could be applied to infestations in other non-riparian sites within the watersheds. These infestations, although not a significant short-term risk to the river mainstem or tributaries, do present a longer term threat as knotweed fragments may still be moved within the watershed by road maintenance or other activities. Similar projects in other watersheds in King County have shown that in subsequent years, control efforts usually incorporate mostly foliar treatments. KCNWCP will assume that will be the case on this river system as well.

Successful control of knotweed in the current project areas could also allow for an expanded knotweed control effort on sites further from the river, or elsewhere in the watershed. There are scattered parks and some greenspaces that would benefit from knotweed removal and as a preventative measure it would be useful to create a buffer area thereby preventing knotweed from returning to the Green/Duwamish River.

## **Conclusion**

The 2006 Green/Duwamish CWMA Invasive Knotweed Control Project achieved another successful season which 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 40 high priority infestations totaling 6.68 net acres for control. These priority infestations were all treated successfully. Knotweed vigor and impacts have been significantly reduced in the project area and no longer impair ecological functioning of these riparian ecosystems. To be effective over time, this project needs to continue to be 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.



*Flaming Geysers State Park before treatment in 2004.*



*Flaming Geysers State Park one month after treatment in 2006.*





*Neely Mansion  
before treatment  
2005.*

*Neely Mansion after treatment 2005.*



*Neely Mansion after  
treatment 2006.*





*Soos Creek before treatment 2004.*



*Soos Creek after treatment 2005*



*Soos Creek after second treatment 2005.*



*Soos Creek regrowth June 2006.*