

# Green River CWMA Invasive Knotweed Control



## 2007 Report



King County

Prepared By  
Monica Walker  
King County Noxious Weed Control Program  
Water and Land Resources Division  
Department of Natural Resources and Parks  
201 S Jackson St, Suite 600  
Seattle, WA 98104  
206-296-0290  
[monica.walker@kingcounty.gov](mailto:monica.walker@kingcounty.gov)

## **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 total 14.47 net acres of knotweed, within 27.79 gross infested acres, was controlled in the Green/Duwamish Watershed in 2007. Twenty-three new sites were found on Soos Creek in 2007, upstream of our original treatment area. The King County Noxious Weed Control Program (KCNWCP) is planning a more intensive survey further upstream on Soos Creek in 2008 to further determine the extent of knotweed.

Knotweed vigor and impacts have been significantly reduced in the project area and no longer impair ecological functioning of these riparian ecosystems. After four consecutive years of control efforts, the majority of sites in the project area are entering the maintenance phase.

## **Project Location and Objectives**

The Green/Duwamish CWMA project is located along the Green River and its major tributaries (Soos Creek, Newuakum Creek, Crisp Creek) in Water Resource Inventory Area (WRIA) 9, King County Washington (Figure 1). The CWMA 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 consists of 93 river miles, and the quality of the riparian zone varies with the surrounding land use, from mixed deciduous and conifer forest to agricultural to industrial. The entire Green/Duwamish watershed (Water Resource Inventory Area 9 or 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 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 reversed 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 2007, the Green/Duwamish CWMA received funding from the USDA-Forest Service, Forest Health Protection (USDA-FS) and US Fish and Wildlife Service (USFWS) 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. The focus of this work was to build on existing data, monitor knotweed distribution and undertake rapid response control work on high priority infestations. Priority actions funded by this project

included survey work to determine the extent of knotweed in the watersheds, community education and outreach, continued rapid response control by work crews and volunteers on identified high priority infestations, and follow-up treatment as needed.

### Green/Duwamish CWMA Invasive Knotweed Control Project

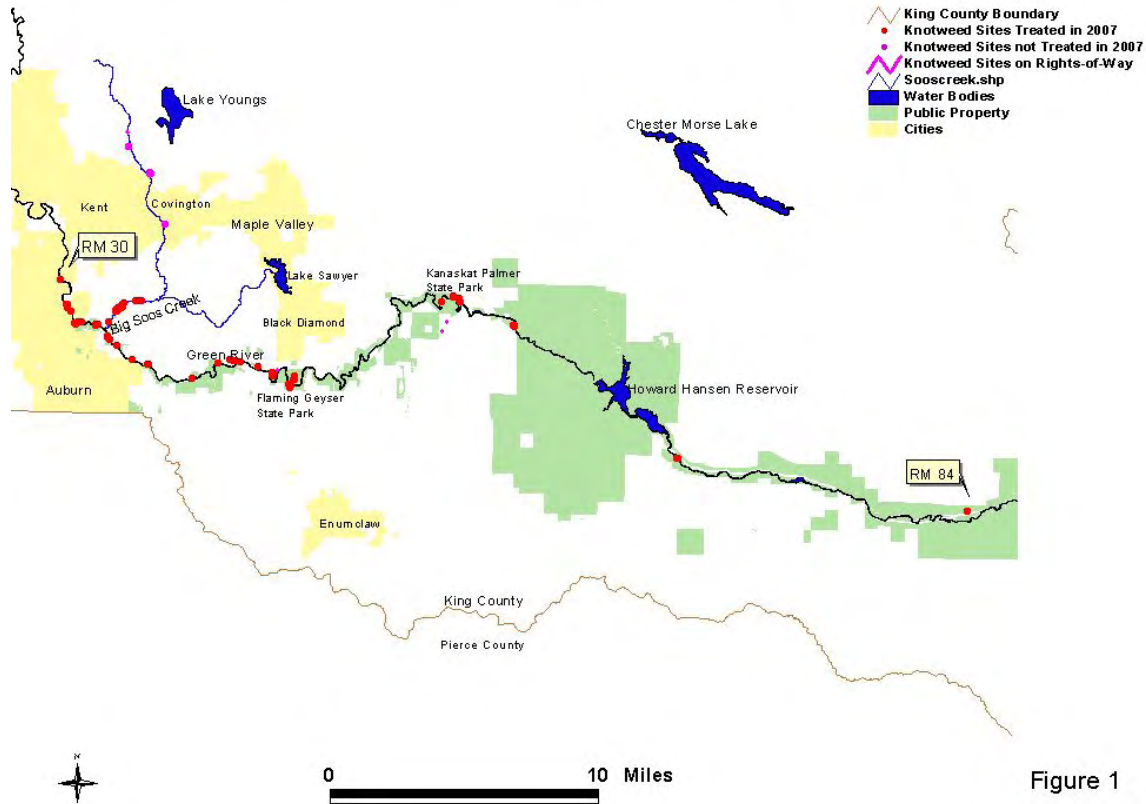


Figure 1

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

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, 2005 and 2006, and continuing surveys and rapid response control in the project area. Tacoma Public Utilities (TPU), King County Parks, Washington State Parks, USFWS, USDA-FS, King County Roads Division and private landowners continued to provide support for this watershed-based knotweed control project.

## **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 2007.

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 (RM) 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 RM 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 RM 32.5, is significantly infested with knotweed for the first three miles. Additional surveys above RM 3 need to be conducted in 2008 to determine the extent of invasive knotweed on Soos Creek. The two 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 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 River began in May 2007 to identify priority infestations for control/eradication.

The Green/Duwamish CWMA project area encompasses approximately 54.5 RMs of the mainstem riparian corridor of the Green River from Tacoma Public Utilities Lester homestead site to Isaac Evans Park within the City of Auburn (RM 85 to 30.5). Surveys along the Green River were conducted by roadside inspections, streamwalking and river rafting. KCNWCP conducted an intensive river rafting survey along 10 RMs of the Green River, from Flaming Geyser State Park to the confluence of Soos Creek (RM 45 to 35) in early June 2007. The remaining 44.5 RMs were spot checked at known sites, road crossings and select properties along the riparian corridor of the Green River. In addition, three river miles of Soos Creek, starting at its confluence with the Green River, and one-half river mile of Crisp Creek were surveyed (See Table 1 below). Twenty-three new sites were found on Soos Creek in 2007, upstream of the original treatment area. Two sites from 2004 and 2005 showed no re-growth in 2006 or 2007 and are not reflected in Table 1.

<b>Stream Name</b>	<b>River Miles Surveyed</b>	<b>River Miles Controlled</b>	<b>Number of Sites (Parcels) 2007</b>	<b>Priority Sites Controlled 2007</b>	<b>Private Parcels</b>	<b>Public Property</b>
Green River	54.5	54.5	49	47	19	30
Soos Creek	3.0	3.0	32	31	28	4
Crisp Creek	0.5	0.5	8	8	8	0
<b>Total</b>	<b>58.0</b>	<b>58.0</b>	<b>89</b>	<b>86</b>	<b>55</b>	<b>34</b>

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

Data was collected using GPS equipment. Recorded data documented: the knotweed species, growth stage, area infested, percent cover of infestation, habitat type, proximity to riparian corridor, condition of knotweed, and UTM coordinates. Recommendations for treatment methods were provided based on site conditions and landowner preference. 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 “net area” which is the sum of the area of the knotweed patches.

### **Knotweed Control Action Plan**

Evaluating site conditions 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 previously was necessary to determine the preferred treatment option on a site by site basis. Knotweed stem injection utilizing glyphosate was selected as the primary treatment option for sites directly adjacent to riparian corridors and foliar applications of aquatic herbicides (glyphosate, imazapyr, agri-dex) was chosen for all other infestations. Knotweed infestations exceeding 10,000 sq ft and located in upland areas were controlled by a foliar application of aquatic herbicides.

Grant funding was primarily used for contractor time, KCNWCP personnel salary, and the purchase of supplies/equipment such as gloves, spray paint, and herbicide. EarthCorps and Washington Conservation Corps (WCC) crews were hired to perform the majority of the stem injection and Woodland Resource Services Inc. was hired to carry out the foliar treatments. 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. A Permit for glyphosate and imazapyr was acquired for each river system involved.

### **Implementation of Action Plan**

Once the priority control sites were identified, KCNWCP began contacting private landowners along the mainstem of the Green River, as well as its major tributaries (Soos Creek, Crisp Creek), to seek their support and consent for knotweed treatment on their property. All private property owners in the Green/Duwamish watersheds contacted agreed with the goals of the CWMA and responded to KCNWCP's request for consent to have the knotweed on their properties controlled in 2007. Fifty-five landowners in the Green River watershed were initially contacted by mail or in person about the knotweed project.

KCNWCP provided knotweed stem injection training in July 2007 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 is to inject each cane between the lowest two nodes using a 3 ml dose of undiluted AquaNeat/AquaMaster, an aquatic formulation of glyphosate, as directed by the herbicide label. The amount of herbicide injected directly into the knotweed canes was reduced from the 5 ml dose used in 2004 on other knotweed control projects, 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.

Stem injection is a labor-intensive control method but the low risk of drift or collateral damage made it the preferred method on sites directly adjacent to river corridors. 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 85% control of all knotweed stems on site and 95% control on all stems that could be injected with a 3 ml dose of glyphosate.

### **Knotweed Control Results**

Funding for control work on the Green River was provided by the USDA – FS, FHP and USFWS. The USDA-FS FHP grant funded the foliar spray efforts conducted by Woodland Resource Services Inc. KCNWCP staff and Woodland Resource Services Inc. sprayed sites throughout the project area using a mix of aquatic glyphosate (AquaMaster/AquaNeat), aquatic imazapyr (Habitat) and a surfactant (Agri-dex). Woodland Resource Services Inc. provided 30 hours of foliar treatment on the Green River in July and August 2007. WCC and EarthCorps crews spent 16 days stem injecting invasive knotweed infestations for the Green River project, which was provided for by USFWS funding.

During the 2007 season, control was achieved on 86 of 89 identified sites selected for treatment along the Green River and its tributaries. One site was not controlled due to access problems,



one site was not controlled because permission was granted after the crews had finished for the season, and one site was not controlled because we couldn't re-locate the small re-growth. 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 62% of the partners and public agencies and municipalities, such as Tacoma Public Utilities, Washington State Parks, Washington State Department of Natural Resources, City of Auburn, King County Roads and King County Department of Natural Resources and Parks account for the remaining 38%. Control of knotweed infestations downstream of Auburn Narrows Natural Area, at RM 33, was accomplished in 2007.

Table 3 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 from 2007 treatment is not known at this time as data has yet to be collected and analyzed.

**Table 3. Invasive Knotweed Species Control in the Green/Duwamish River Watershed\* in 2007**

<b>Ownership</b>	<b>Gross Knotweed Area Infested<sup>1</sup> in 2007 (sq ft)</b>	<b>Net Knotweed Infested Area<sup>2</sup> in 2007 (sq ft)</b>	<b>Net Knotweed Area Treated<sup>3</sup> in 2007 (sq ft)</b>
King County Lands	219,423	72,370	69,870
Washington State Lands	123,019	21,434	21,434
Tacoma Public Utilities	4,590	4,325	4,325
City of Auburn Lands	32,280	4,720	4,720
Privately Owned Lands	831,263	530,093	530,093
<b>Total in Sq Ft</b>	<b>1,210,575</b>	<b>632,942</b>	<b>630,442</b>
<b>Total in Acres</b>	<b>27.79</b>	<b>14.53</b>	<b>14.47**</b>

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

\*\*4.27 net acres were controlled with USDA-FS FHP funds. The remaining 10.2 net acres were controlled with USFWS funds

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 efficacy of follow-up control has increased with the addition of imazapyr to our herbicide spray mixture. Rates of control on sites sprayed in 2006 with a foliar treatment of 2% aquatic glyphosate, 1% aquatic imazapyr and 1% surfactant resulted in between 88% and 99.7% control with an overall average of only 3% re-growth in 2007. Due to the addition of the aquatic herbicide imazapyr to our control efforts, monitoring the 2007 treatments will be done in spring 2008. Information on imazapyr suggests that monitoring the year following a treatment is necessary due to its mode of action. According to the label, imazapyr is absorbed through emergent leaves and stems and translocated throughout the plant, killing underground storage organs preventing re-growth. The label also states that complete kill of plants may not occur for several weeks.

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 86 sites in the watersheds. The total acreage controlled in the Green/Duwamish

watershed in 2007, with funding from USDA-FS and USFWS, was 14.47 net acres of knotweed within 27.79 gross infested acres.

KCNWCP will begin the monitoring phase of this project in May 2008. The last day of control was September 28<sup>th</sup>, 2007 and effects are just beginning to show at this time. Efficacy will be assessed in early spring 2008.

## **Education and Outreach**

Sasha Shaw, Noxious Weed Education Specialist, and Monica Walker, Project Manager, conducted Education and Outreach activities for landowners, control crews and volunteers in the Green River watershed. The Education and Outreach events conducted in 2007 include the following:

- 1) Covington Waterwise Garden Fair, 6/23/07, 70 participants, presentation slideshow and information booth on invasive weeds including knotweed with knotweed fact sheets to give out.
- 2) Maple Valley Invasive Weed Workshop, 6/26/07, 14 participants, presentation for the general public on invasive weeds including knotweed with knotweed fact sheets to give out.
- 3) EarthCorps and Washington Conservation Corps crews training, 07/12/2007, 07/13/2007 and 07/16/2007, 48 participants. Presentation on knotweed, its biology, ecology and control methods as well as hands-on stem injection training.
- 4) King County Fair, 7/18/2007-07/22/07, 731 visitors to the Noxious Weed Booth. Gave out knotweed fact sheets and answered questions from the general public on knotweed.
- 5) Duwamish River Cleanup Coalition Youth Group, 07/24/07 and 08/14/07, 21 participants, knotweed presentation and hands-on control (stem bending) training.
- 6) Shadow Lake Bog Outreach Event, 08/12/2007, 37 visitors to staffed table at community event. Answered questions about invasive weeds including knotweed and gave out knotweed fact sheets.

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>).

## **Discussion**

The 2007 control strategy for invasive knotweed did not change from the 2006 control strategy. The re-growth from sites injected in 2004, 2005 and 2006 was significantly less robust and unsuitable for injection. As a result, foliar applications increased in 2007. The preventative strategy used in prior years, 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 continue to extend downstream.

Any changes for the Green/Duwamish CWMA project objectives in 2008 will be largely dependent upon information collected from monitoring the 2007 control work and the amount of funding the project receives. Control efforts in 2008 on the Green River will include foliar applications of the aquatic herbicides glyphosate and imazapyr. These projects have shown that control efforts in subsequent years usually incorporate mostly foliar treatments and we will assume that to be the case in 2008 as well.

## **Conclusion**

The 2007 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 ecosystems. The watershed was extensively surveyed and an action plan identified 89 high priority infestations, totaling 14.47 net acres for control. To be effective over time, this project needs to continue, leading to 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.



*Hatchery Park May 2007*



*Near Hatchery House 2004*



*Behind Hatchery House after First Treatment 2005*





*Behind Hatchery House June 2006*



*Behind Hatchery House May 2007*





*Crisp Creek After First Treatment October 2005*



*Crisp Creek Spring 2007*





*Crisp Creek Right-of-Way After First Treatment 2004*



*Crisp Creek Right-of-Way Regrowth June 2006*





*Riverbank on Soos Creek June 2006 near Logjam*



*Riverbank on Soos Creek May 2007 near Logjam*





*SE 309<sup>th</sup> St Right-of-Way 2004*



*SE 309<sup>th</sup> St Right-of-Way 2005*





*SE 309<sup>th</sup> St Right-of-Way June 2006*



*SE 309<sup>th</sup> St Right-of-Way 2007 - Still no Regrowth*