Rock Creek Wetland Habitat Restoration Project
As-Built Document, 2002 - 2017

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Background

Rock Creek Wetland (RCW) is located in the western portion of the Cedar River Municipal Watershed (CRMW, figure 1). It is the largest low-elevation wetland complex in the municipal watershed, located at 720-760 feet above sea level (asl) and encompassing over 200 acres of open water, shrub and herb-dominated wetland, wet forest, and bog. The headwaters of Rock Creek are on Brew Hill at an elevation of approximately 2,450 feet asl. Once the creek enters the area of low topographic relief and the wetland complex, it is no longer restricted to a single channel. Rock Creek drains an area of over 3,100 acres (figure 2) and empties into the Cedar River 2.1 miles upstream of the Landsburg Diversion Dam. The diversion dam was built in 1901 and blocked fish passage for over 100 years. In 2003 a fish ladder allowed access to over 12.5 miles of habitat in the Cedar River above the dam, plus habitat in Rock Creek and RCW. Since then Coho salmon (*Oncorhynchus kisutch*) have been documented spawning in Rock Creek and may be using portions of RCW as rearing habitat.

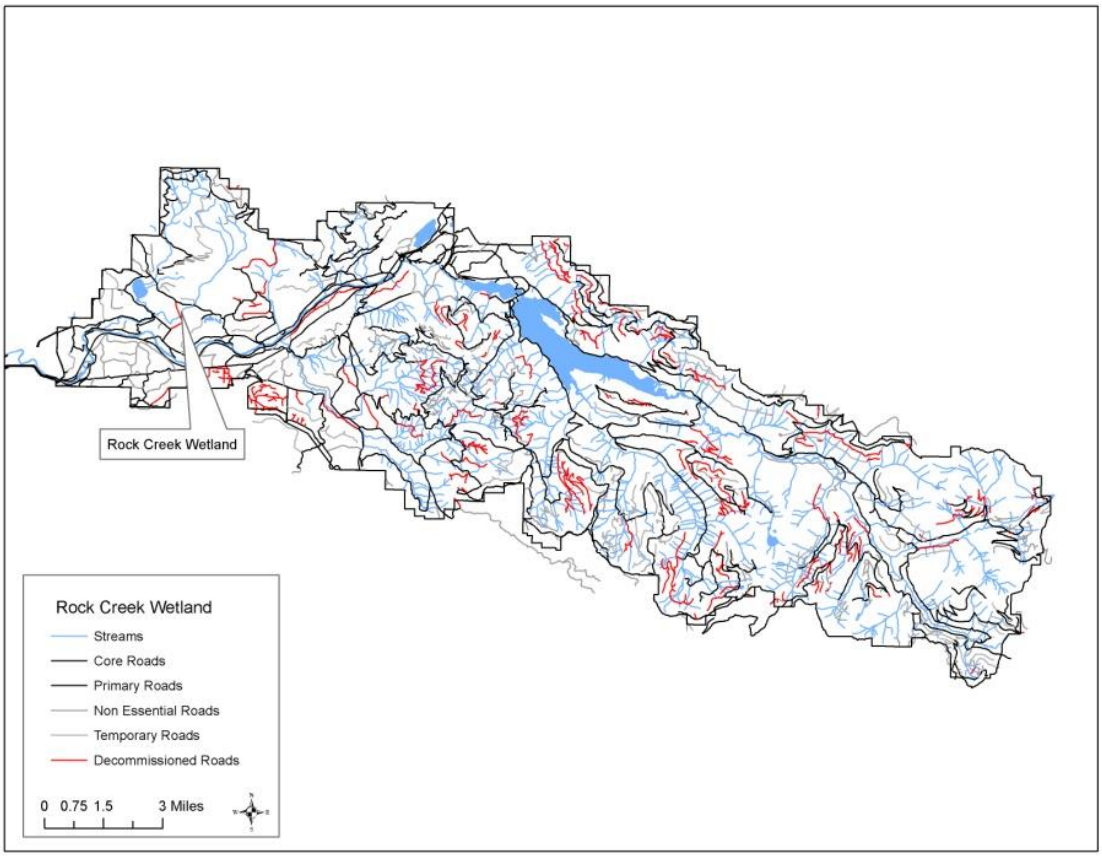

Figure 1. Location of Rock Creek Wetland within the municipal watershed

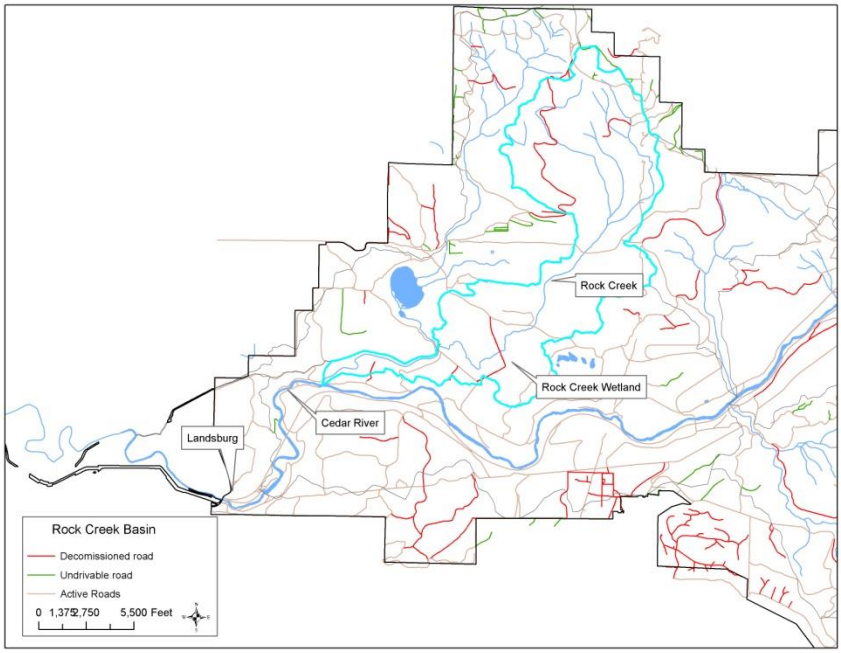

Figure 2. Rock Creek drainage area (highlighted in blue)

Rock Creek Wetland is an important amphibian breeding area for red-legged frogs (*Rana aurora*), northwestern salamanders (*Ambytoma gracile*), Pacific tree frogs (*Pseudacris regilla*), long-toed salamanders (*Ambystoma macrodactylum*), and roughskinned newt (*Taricha granulose*). Beaver (*Castor canadensis*) are very active within the wetland complex, creating numerous dams that frequently change the water levels in portions of the site. They directly and indirectly create abundant snags and downed wood. This diverse habitat supports numerous bird and mammal species, many of which are listed in the Cedar River Watershed Habitat Conservation Plan.

Although a complete plant inventory has not been completed, RCW is currently botanically diverse, supporting a variety of native plant species ranging from coniferous and deciduous trees, to shrubs, forbs, herbs, grasses, sedges, and aquatic plants. The wetland also contained large infestations of non-native invasive plant species, including dense patches of Bohemian knotweed (*Polygonum* x *bohemica*, a hybrid between Japanese (*P. cuspidate*) and giant knotweed (*P. sachalinense*), large thickets of both Himalayan (*Rubus armeniacus)* and evergreen (*Rubus laciniatus*) blackberry, large dense mats of bittersweet nightshade (*Solanum dulcamara*), and several large patches of reed canary grass *(Phalaris arundinancea*). English holly (*Ilex aquifolium*) is scattered throughout the forest and there are a few isolated butterfly bush (*Buddleja davidii*) and tansy ragwort (*Senecio jacobaea*) plants.

The forest surrounding RCW was harvested for timber in the early 1900s, and there were homesteads in the vicinity, which were likely the source of many of the non-native plant species (figure 3). The 16 Road was built through the center of the wetland in order to extract timber and was maintained through the early 1990s. Because of the importance of RCW for a large number of fish and wildlife species, as well as its size and complexity, it was a high priority for

restoration work. Details of habitat restoration and invasive species control work in RCW can be found in Appendix I.

Figure 3. Homesteads near RCW in 1911

Project Objectives

The project objectives are to functionally reconnect the wetland, restore the natural hydrology, and restore native plant systems and ecosystem functioning. Specific objectives include eradicating knotweed, butterfly bush, and tansy ragwort, reducing or eliminating the large thickets of blackberry and large matting areas of nightshade and reed canary grass, thereby greatly reducing the ecological influence of these species.

Restoration Treatments

Project objectives are being achieved in phases over many years. Treatments were prioritized and implemented as funding and staffing allowed (discussed in order of priority below). Treatments include:

- Road decommissioning to reconnect the wetland and help restore the natural hydrology
- Invasive plant species control and eradication by various methods
- Planting native plant species to restore native plant systems and ecosystem functions, as well as suppress non-native invasive species

Road Decommissioning

Decommissioning the 16 Road was the highest priority and was completed by Seattle Public Utilities Watersheds Operations staff in 2002. Road fill was removed from strategic locations and major portions of the wetland were hydrologically reconnected. Portions of the roadbed where fill was removed now have water at or near the surface for much of the year and native vegetation has completely recolonized these sites (figure 4). Fill was removed from the two major channels of Rock Creek and the channels were restored to natural streambeds. Wood was strategically placed near the channel closest to the 10 Road to minimize the chances the creek would flow along the old 16 Road roadbed and threaten the integrity of the 10 Road. In subsequent years, flow in Rock Creek has moved between the two major channels; at times all

the flow has been in one channel and at other times the flow has split between the channels, with varying amounts in each channel. Flow in Rock Creek downstream of the 16 Road becomes much more dispersed and affected by the numerous beaver dams.

Figure 4. Section of the 16 Road in RCW in 2002 (left) and after removal in 2006 (right).

In areas where fill was not removed, the roadbed surface was broken and was initially planted with over 1,600 native trees and 70 native shrubs shortly after the decommissioning was completed in 2002. This helped to diversify the native plant community as well as suppress some non-native invasive species. There was vigorous plant growth of some species over the next ten years, particularly Sitka spruce and by 2014 in some areas it was becoming difficult to tell where the old roadbed had been (figure 5).

Figure 5. Planted conifers ten years after road decommissioning of the 16 Road (left) and restored Rock Creek channel at the 16 Road crossing (right).

Invasive Plant Surveys

RCW was surveyed intensively for invasive species 2007-2014 (figure 6). During these surveys, all knotweed, Himalayan and evergreen blackberry thickets and individual large blackberry plants, nightshade mats, butterfly bush, and English holly were mapped on a geographic information system using global positioning system points taken in the field (figure 7). In 2014

staff began to survey and map large infestations of reed canary grass. Further information about on-going surveys is provided in the monitoring section below. The majority of non-native invasive plants were located along or near the old decommissioned roadbed that bisected the wetland, and near active and former channels of Rock Creek. Portions of the wetland more distant from these disturbance centers have a large and diverse native plant community with few invasive species present.

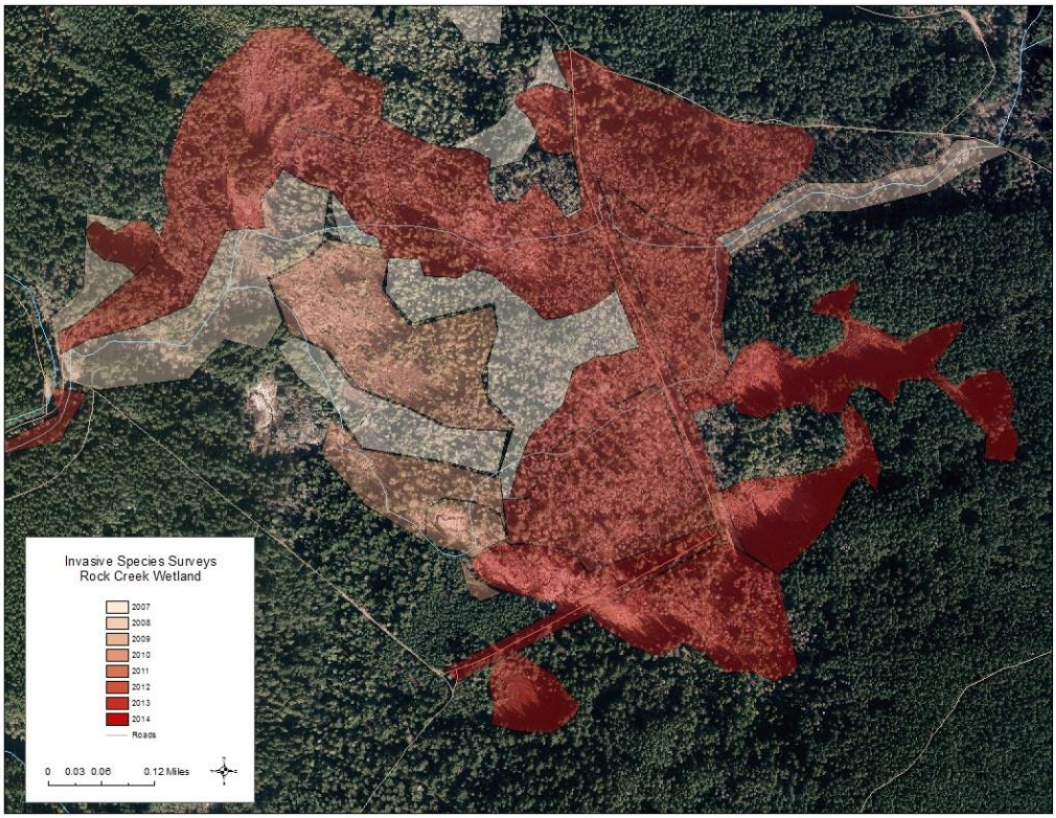

Figure 6. Invasive species surveys in RCW, 2007-2014

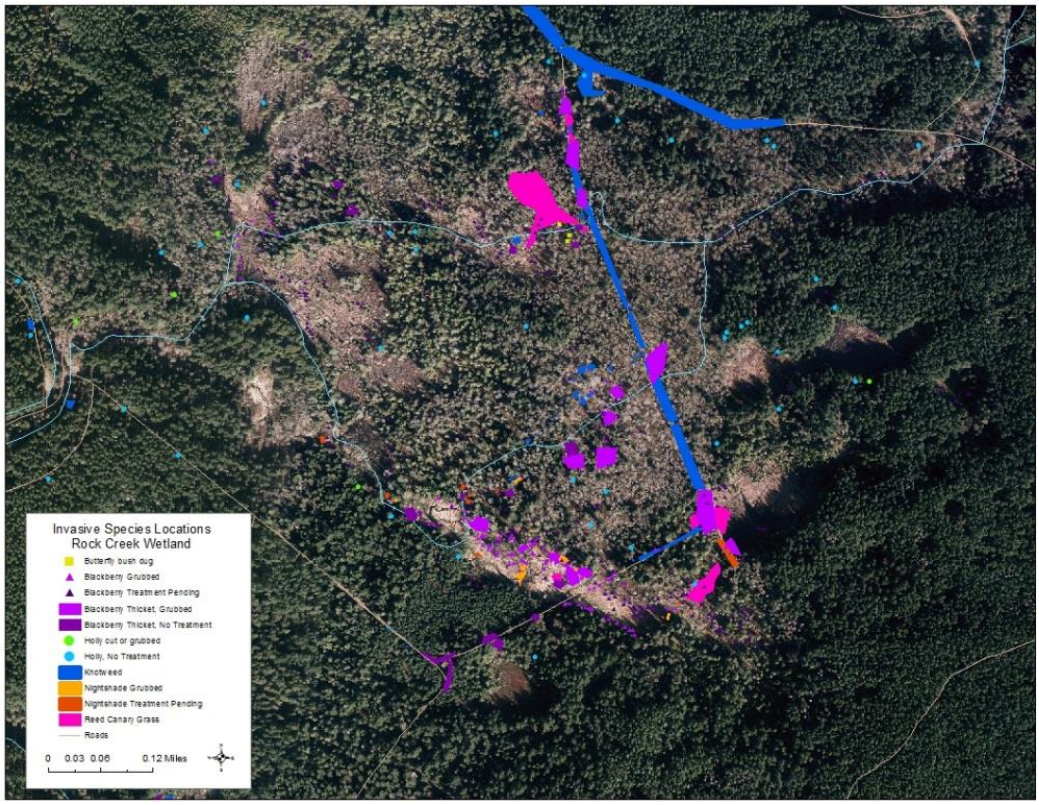

Figure 7. Location of major invasive species in RCW

Knotweed Treatment

Although knotweed is not yet legally required to control throughout King County, it poses one of the greatest ecological threats of any invasive plant species within the watershed, and as such was the highest priority species for initial treatment. At the time of road decommissioning in 2002, there was an extremely dense knotweed infestation (~15,000 ft^2) that extended for more than 500 feet along the road, starting at about 1,900 feet south of the 10 Road. During the decommissioning, the knotweed roots were dug out with heavy equipment, hauled off site, and buried in an old gravel pit. This process was unsuccessful in controlling the knotweed and resulted in spreading the infestation along a much larger portion of the roadbed (~30,000 ft^2) as early as 2003 (figure 7). Knotweed was pulled during two volunteer events in 2003, but this limited effort was also ineffective in controlling the infestation.

In the early 2000s herbicide use (the preferred and often only effective treatment for knotweed) within the municipal watershed was completely prohibited, leaving only mechanical treatment options. Since pulling large established infestations is ineffective, in 2004 we attempted to starve the knotweed roots by covering over 25,000 ft^2 of the dense infestation along the old roadbed. We initially used three different types of fabric – heavy black plastic, woven plastic geotextile fabric, and non-woven felt geotextile fabric. The black plastic tore easily, so over the next several years we replaced torn sections with the more durable geotextile fabric. The fabric was placed over the most heavily infested areas, i.e., those areas along the roadbed adjacent to the forest edge. The center of the roadbed generally had isolated individual knotweed plants, and was left uncovered to function as a wildlife travel corridor. The fabric was placed loosely over the dense patches and anchored at the edges with rocks or logs (figure 8). This allowed some

plant growth underneath without tearing through the fabric. Significant growth under the fabric generally only occurred during the first two growing seasons after the fabric was placed.

Figure 8. Knotweed during winter lining Road 16 prior to decommissioning (left) and fabric placed over the knotweed in 2004 along the edges of the decommissioned road (right).

Portions of the wetland away from the 16 Road were surveyed each year, culminating in a 2007 systematic search for knotweed with numerous staff and expert volunteers walking parallel transects through the wetland. Several large knotweed infestations away from the 16 Road were discovered and an additional 5,000 ft^2 of fabric was installed on these patches. Additional surveys were conducted, and as of 2014 the wetland had been completely surveyed for knotweed. Only occasional individual plants were found after the 2007 search.

All knotweed patches were monitored, fabric maintained, and isolated knotweed plants pulled multiple times per year from 2004 through 2011. This took from five to nine staff person days per year, plus varying amounts of contractor days, depending on how much black plastic needed to be replaced and new fabric installed each year (see Appendix I for a complete description of work completed by year, including number of staff, contractor, and volunteer days and contractor costs). Within a few years, the uncovered areas in the center of the roadbed became thickly vegetated with native species (both planted and naturally regenerated) and the frequent pulling slowly diminished the number of isolated knotweed plants.

In 2008, a small amount of fabric (400 ft^2) was removed from small knotweed patches in areas that were inundated for much of the year. No subsequent knotweed growth was seen in these patches, so in 2009 an additional 4,400 ft^2 of fabric was removed from smaller patches (after five years of covering). This also yielded no further growth, and in 2010 and 2011 the remaining fabric along the roadbed was removed. In some of the larger areas with the initially densest infestations, there was considerable re-growth of small knotweed plants even after six or seven years of continual covering, casting doubt on the efficacy of the fabric method for large patches.

In 2010 Seattle City Council passed Council Bill #116902, an ordinance that allowed limited application of the herbicide Imazapyr to treat knotweed within the municipal watershed from 2010-2012. Because the fabric treatment was unsuccessful in controlling the larger patches

along the decommissioned 16 Road, in 2011 and 2012 we did limited spot applications to the knotweed regrowth as part of the larger knotweed treatment within the watershed. Because it can often take eight or more years of herbicide treatment to kill the root systems of large knotweed patches, subsequent ordinances were passed in 2013 and 2016, allowing continued Imazapyr use to treat knotweed through 2018. The herbicide treatment is working, and fewer plants are being found and treated in RCW each year. The goal is to completely eradicate knotweed from wetland.

Annual reports to Seattle City Council on knotweed treatment using herbicide in the CRMW, starting in 2010, are available in the project plans and reports section of: http://www.seattle.gov/util/EnvironmentConservation/OurWatersheds/Habitat_Conservation_Plan/ManagingtheWatershed/StreamRiparianHabitatRestoration/Metrics/index.htm

Invasive Blackberry Treatment

Both Himalayan and evergreen blackberry form large thickets that out-compete and displace native wetland plants. Because these species are so common in King County, they are not legally required for control. However, control is highly recommended, especially in wetland and riparian areas, because of the large negative ecological effects they exert. We began grubbing out blackberry thickets and individual plants along the 16 Road and within the wetland in 2005. We continue to work on removing blackberry as resources allow, and have made significant progress (figure 9). Because blackberry can re-growth from root fragments and seeds are viable for many years, each blackberry site needs to be treated for multiple years to significantly reduce its footprint. Large efforts were conducted in 2006, 2008, 2009, 2010, 2013, 2014, 2015, and 2017, primarily using contractors. Currently, virtually all large thickets have been reduced to scattered individual plants, and many individual plants have been eliminated. It is much more cost-effective to treat blackberry when they are still individual plants, and we will continue to control these species throughout the wetland as resources allow, to further reduce their impact on native ecological functions.

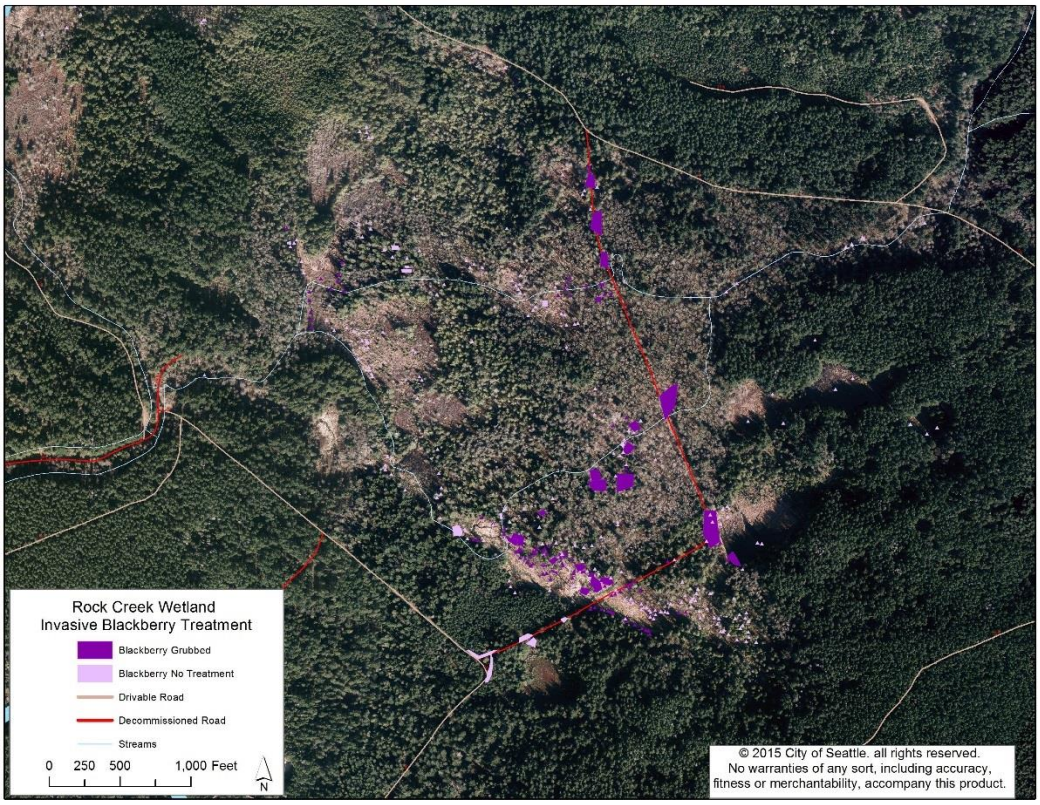

Figure 9. Invasive blackberry treatment in RCW

Bittersweet Nightshade Treatment

Bittersweet nightshade is not legally required for control, but King County recognizes it is invasive and lists it as a weed of concern recommended for control. It is highly toxic, and has caused fatal poisoning of both children and livestock. Its effects on native wildlife are unknown, but it likely causes death if eaten in sufficient quantities. During RCW surveys, huge dense mats of nightshade were found that completely blanketed large areas. It was so thick that a person could walk on the mats over open water. These mats were clearly displacing native plants and likely disrupting native ecosystem functioning, so were a high priority for removal. The largest mats of nightshade were grubbed out and removed from the wetland in 2009 and 2010, (figure 10).

Numerous smaller nightshade mats were removed in 2012, 2013, and 2014, with much of the work grant funded. Grubbing out the roots and piling the plants in dry areas to desiccate appeared to be largely successful. We temporarily covered many of the root piles with fabric to prevent regrowth. There was some limited re-growth in the original matted sites that had to be treated in following years to prevent a recurrence of the mats. Individual nightshade plants are still scattered widely throughout the wetland, but recent surveys have revealed no further large mats. If any large mats are discovered, they will be grubbed out as resources allow. Treated sites will continue to be monitored and re-grubbed periodically as needed.

Figure 10. Nightshade mat along a beaver dam before (2006, left) and after (2009, right) removal.

Reed Canary Grass Treatment

Reed canary grass has recently been recognized as one of the most invasive and damaging non-native species creating monocultures in western Washington wetlands. By late 2014 knotweed, blackberry, and nightshade were largely under control, so staff turned to the next highest priority, reed canary grass. Initial mapping of the large patches of reed canary grass adjacent to the old decommissioned roadbed was completed (figure 7). There were large canary grass patches deep in the wetland (about 3,000 feet south of the 10 Road) in an area that was until recently the bottom of a beaver pond, as well as a very large site near the active Rock Creek channel about 1,000 feet south of the 10 Road. Because the former beaver pond area was immediately adjacent to an active beaver colony that would likely cause major damage to a restoration project (eat planted seedlings), we decided to focus first on the sites closest to the 10 Road (figure 11).

Other western Washington land managers have found that smothering growth with some type of mulch and planting very densely with native trees and shrubs has been successful in reducing canary grass cover in wetland areas. In late 2014 we first spread geotextile fabric over the bulk of the infestation in the four treatment sites, to help suppress the grass and allow the seedlings to grow to sufficient height to overtop and out-compete the grass. We then cut holes in the fabric and planted 4300 native shrubs and 125 native trees (figure 12). Shrub species were generally planted in small groups by species (clusters of 10 or so plants of each species), while trees were scattered. Willow was planted very densely (two feet on center), while other shrubs were generally planted four feet apart (figure 13). The goal of this very dense planting is to provide long-term shade that will suppress the grass, as well as to diversify the native plant community.

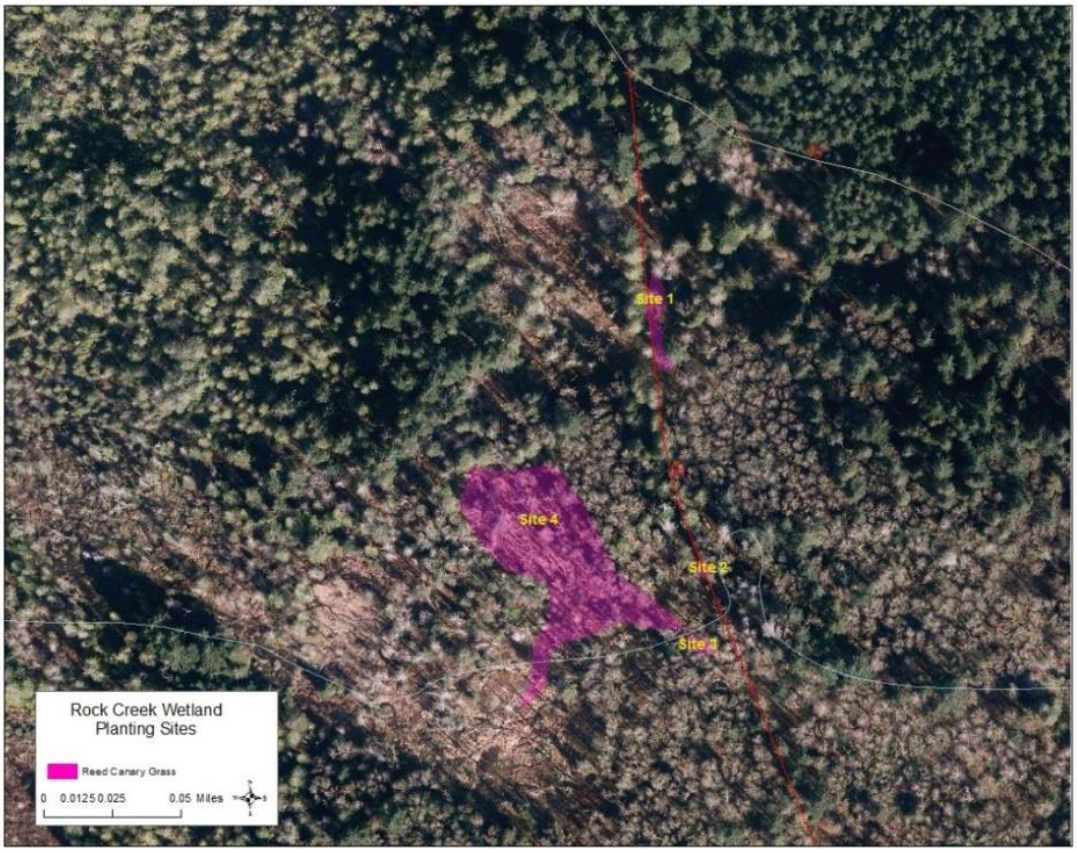

Figure 11. 2014 reed canary grass treatment sites

Figure 12. Reed canary grass before (left) and during the 2014 treatment (right), when fabric was placed and areas for species groups were delineated by orange paint.


Figure 13. Densely planted willow (left) and other native shrubs (right) during 2014 planting.

The covering of the small reed canary grass patches appeared to successfully suppress the growth. However, the grass grew aggressively through the holes, along the edges, and on top of the large fabric patches. The main large site (Site #4 in figure 11) was cleared again in 2015, 2016, and 2017. The initial late-2014 planting in this site had very high mortality during the summer of 2015, one of the driest summers on record. It was replanted in late 2015 with a smaller suite of more drought-resistant species. Native plantings were densified in early 2017 and early 2018.

Planting Native Species

We have added numerous native trees and shrubs over the years to diversify and restore the native plant community, as well as suppress knotweed and other non-native invasive species (Table 1). Planting started in 2002, just after the road decommissioning was completed (described above). In 2007 we planted 470 native conifer trees and 192 native shrubs around the knotweed fabric edges on the old roadbed and in the wetland to help provide shade to suppress knotweed over the long-term. In 2011 we planted an additional 89 conifer trees within the knotweed patches after fabric had been removed to help provide shade, which should make the growing conditions less favorable to knotweed over the long term. In 2014 we planted a total of 3550 native shrubs (13 species) and 875 trees (6 species). Most were within the covered reed canary grass treatment areas described above, with some shrubs scattered along the old roadbed. The reed canary grass site was replanted in late 2015 and again densified in late 2017 and early 2018.

Table 1. Native trees and shrubs planted in RCW

Species		Year					
Common Name	**Scientific Name**	**2002**	**2007**	**2011**	**2014**	**2015**	**2017**
Overstory Trees							
Big Leaf Maple	*Acer macrophyllum*	30					
Black Cottonwood	*Populus balsamifera*				100	170	
Douglas Fir	*Pseudotsuga menzieisi*	432	92				
Shore pine	*Pinusc ontorta*					100	
Sitka Spruce	*Picea sitchensis*	390	150	30	25	105	
Western Hemlock	*Tsuga heterophylla*	25	150				
Western Red Cedar	*Thuja plicata*	710	123	59		36	
Western White Pine	*Pinus monticola*	25					
Total Trees Planted		**1612**	**515**	**89**	**125**	**411**	**0**
Understory Trees and Shrubs							
Bitter Cherry	*Prunus emarginata*				200		
BlackTwinberry	*Lonicera involucrata*	30			200	100	32
Cascara	*Rhamnus purshiana*	4	30		250	35	
Dogwood, red osier	*Cornus sericea*	30			200		
Douglas Hawthorne	*Crataegus douglasii*	3			100		
Goatsbeard	*Aruncus dioicus*				200		
Indian plum	*Oemleria cerasiformis*				200	50	
Lewis mock-orange	*Philadelphus lewisii*				200		
Oceanspray	*Holodiscus discolor*		30				
Pacific Crabapple	*Malus fusca*				200	100	
Pacific Ninebark	*Physocarpus capitatus*		60		200		50
Peafruit rose	*Rosa pisocarpa*				250		50
Red elderberry	*Sambucus racemosa*				200		
Sweet gale	*Myrica gale*				300		
Thimbleberry	*Rubus parviflorus*				200		
Vine maple	*Acer circinatum*	5	20		200		
Willow, Pacific	*Salix lucida*				600	175	200
Willow, Hooker	*Salix hookeriana*						193
Willow, Scoulers	*Salix scouleriana*					50	
Willow, Sitka	*Salix sitchensis*				600		
Total Shrubs Planted		**72**	**140**	**0**	**4300**	**510**	**525**

Other Invasive Plant Species Treatment

A total of three butterfly bush plants were found and grubbed out in 2008 and 2010. No other butterfly bushes have been found during subsequent years. Only a few individual tansy ragwort plants are occasionally found along the decommissioned roadbed. All are pulled as soon as they are found. English holly has been mapped, but only small seedlings have been pulled. The trees are generally few and scattered, and do not appear to be negatively affecting ecological function in the wetland. As part of the early detection/rapid response protocol of the Watersheds Invasive

Species Program (see monitoring section below), greater burdock (*Arctium lappa*) and foxglove (*Digitalis purpurea*) are pulled whenever they are found, in order to prevent these non-native species from spreading into the wetland. Burdock was becoming quite common along the old roadbed in 2004, but after treatment is only occasionally seen. Foxglove was found in high concentration in a single site near a channel of Rock Creek in 2011, and most plants are pulled annually prior to seeding. By 2014 far fewer foxglove were seen, so the treatment appears to be successful.

Monitoring

A key tenant of the Major Watersheds Invasive Species Program is the Early Detection/Rapid Response (EDRR) protocol. This strategy involves routine surveys for invasive species, including surveying for species already present as well as species that potentially could invade but have not yet been documented. If a new infestation is found, it is rapidly treated while it is still small enough to eradicate in a cost-effective manner and before it has a chance to spread and cause ecological damage. This strategy has been proven world-wide to be the most cost-effective way to deal with invasive species. The full Invasive Species Program Management Plan may be viewed at:
http://www.seattle.gov/util/EnvironmentConservation/OurWatersheds/Habitat_Conservation_Plan/ManagingtheWatershed/ProtectWatershedHabitats/ProtectionEfforts/index.htm#invasiveSpecies

Annual monitoring in RCW to document treatment success and to detect any new threats is ongoing and occurs in a rotating panel design, i.e., a portion of the wetland is surveyed each year, such that each section is surveyed at least once every five years. The wetland was divided into seven large sections, plus two bogs (figure 14). Each section is surveyed on a schedule according to its evaluated risk.

Because knotweed is such a major threat and such a large amount of effort has been put into eradicating it, all known sites of knotweed are monitored annually (portions of sections 1, 2, and 4). Any new knotweed plants found are treated that year. Section 2 is surveyed annually as part of the annual amphibian egg mass survey (see below). Sections 1 and 4 have the highest current levels of invasive species and are usually surveyed during years when treatments are conducted. The remaining sections and the bogs are at lower risk and are surveyed less often, about once every five years.

As part of the EDRR strategy, in 2008 we conducted an aquatic survey for Eurasian milfoil (*Myriophyllum spicatum*) in areas of the wetland that could support this plant. No milfoil was found.

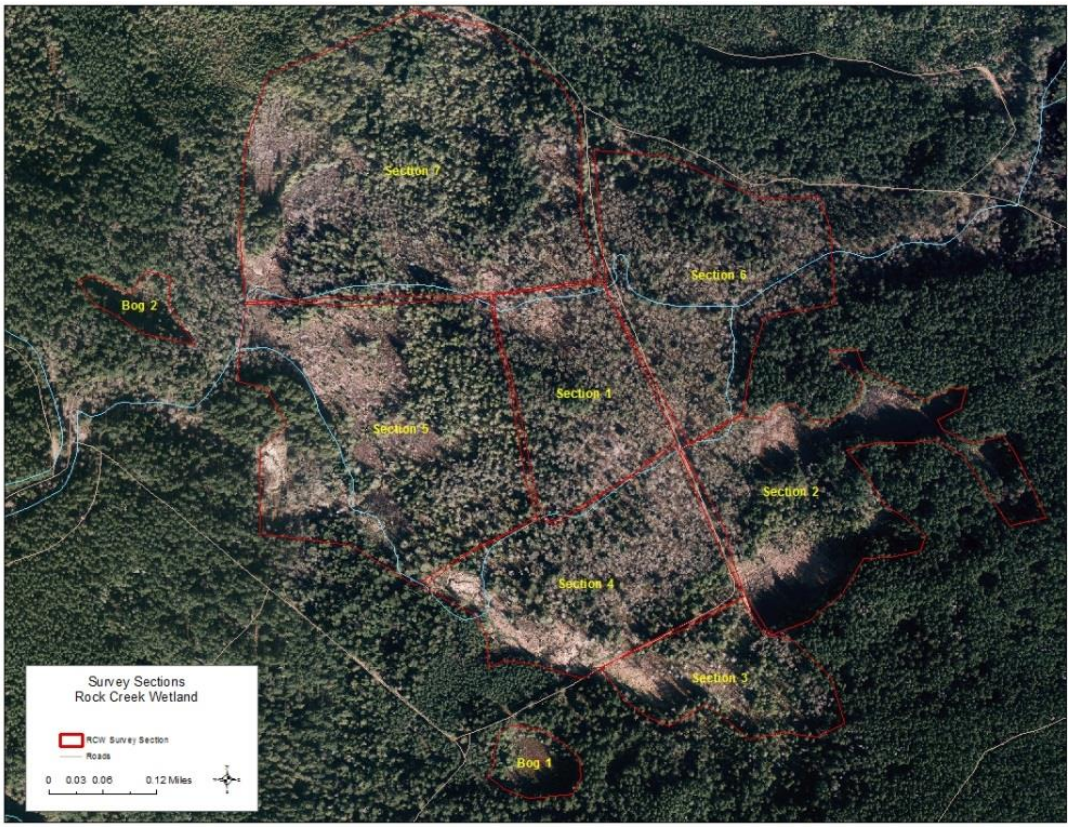

Figure 14. Survey sections for rotating panel design, RCW

In addition to plant surveys, amphibian egg mass surveys are conducted annually in areas of the wetland that provide suitable breeding habitat (Section 2 and portions of Sections 3 and 4). Two species (red-legged frogs and northwestern salamanders) are sufficiently abundant to be tracked. For more information see http://www.seattle.gov/util/About_SPU/Water_System/Habitat_Conservation_Plan/Species/Amphibians/Pond-Breeding/StatusintheCedar/index.htm .

This amphibian breeding information, along with the invasive plant survey data, provide staff with a system to detect negative changes within the wetland that we can then respond to with appropriate management actions in a timely fashion.

Appendix I

Details of habitat restoration work conducted in the Rock Creek Wetland

Year	Focus	Restoration Work	Notes	Staff Person Days	Contractor Person Days	Contractor, Supplies Cost	Volunteer Person Days
2002	Decommission	16 Road decommissioned	SPU Operations crew remove fill, break apart compacted surface	na			
	Planting	Plant native species along decommissioned roadbed	1,612 trees, 72 shrubs	1		$1,275	22
2003	Knotweed	Pull knotweed	1 volunteer event in June	1			10
2004	Knotweed	Install fabric	Install 25,000 ft^2 of fabric over patches along decommissioned 16 road (3 types of fabric - black plastic and 2 geotextile)	5	5	$1,200	6
	Knotweed	Maintain fabric/pull plants	Stomp all growth under fabric, repair fabric, pull all knotweed plants	5			
2005	Knotweed	Maintain fabric/pull plants	Repair fabric, stomp all growth under fabric, pull all knotweed plants. Replace torn black plastic with geotextile & haul out old plastic	8			
	Blackberry	Grub out thickets & individuals	Along decommissioned road	0.5	3	$600	
2006	Knotweed	Install fabric	Cover newly found large patches within wetland with 4,850 ft^2 fabric	2	13.5	$2,700	
	Knotweed	Maintain fabric/pull plants	Repair fabric, stomp all growth under fabric, pull all knotweed plants. Replace torn black plastic with geotextile & haul out old plastic	7	6	$1,200	
	Blackberry	Grub out thickets & individuals	Along decommissioned road and within wetland	3	12	$2,400	
	Thinning	Thin alder	Thin around planted conifers provide sufficient growing space	0.5	2.5	$600	

Year	Focus	Restoration Work	Notes	Staff Person Days	Contractor Person Days	Contractor Cost	Volunteer Person Days
2007	Planting	Plant native species	Plant 470 trees, 192 shrubs along roadbed and within wetland around covered knotweed patches. Cost includes plant purchase.	3	5	$1,900	19
	Knotweed	Survey	Walk transects through wetland surveying for knotweed with King County Noxious Weeds and SPU staff	5			4
	Knotweed	Install fabric	Cover 3 newly found patches within wetland with 680 ft^2 of fabric	1	1	$200	
	Knotweed	Maintain fabric/pull plants	Repair fabric, pull all knotweed plants. Replace torn plastic with geotextile & haul out old plastic.	6	10	$2,000	
	Blackberry	Survey	Survey along Rock Creek and within wetland; Map all blackberry found	2			
2008	Knotweed	Maintain fabric/pull plants	Repair fabric, pull all knotweed plants. Replace torn plastic with geotextile & haul out old plastic.	9	10	$2,000	
	Knotweed	Remove fabric	Remove 400 ft^2 fabric from small patches placed in 2004, now inundated	0.5	5	$1,000	
	Knotweed	Install fabric	Cover newly found patch within wetland with 200 ft^2 fabric	0.1			
	Target Invasive Species	Survey	Survey within wetland; Map locations of invasive species found	6			

Year	Focus	Restoration Work	Notes	Staff Person Days	Contractor Person Days	Contractor Cost	Volunteer Person Days
2008 (cont)	All legally required invasive species	Survey	Expert botanists conducted walking survey in northwest and south portions of the wetland for all terrestrial species legally required to control, plus Canada and bull thistle		4	$1,280	
	Milfoil	Survey	Contractor conduct aquatic survey for milfoil - none found.		1	$3,700	
	Butterfly Bush	Grub out	One plant found and grubbed out	0.1			
	Blackberry	Grub out thickets	Within wetland		51	$10,200	
2009	Knotweed	Maintain fabric/pull plants	Repair fabric, pull all knotweed plants.	7.5	9	$2,800	
	Knotweed	Remove fabric	Remove ~4,400 ft^2 of fabric from small areas installed in 2004 and now very wet. Haul out old fabric.	1	10	$3,900	
	Target Invasive Species	Survey	Survey within wetland; map locations of invasive species found	2			
	Blackberry	Grub out thickets	Within wetland	0.5	9	$2,800	
	Nightshade	Grub out/remove dense patches	Within wetland	0.5	9	$2,800	
2010	Knotweed	Maintain fabric/pull plants	Repair fabric, pull all knotweed plants.	4			
	Knotweed	Remove fabric	Remove ~5,500 ft^2 of fabric installed in 2004 along decommissioned road.	1.5	10	$2,075	
	Target Invasive Species	Survey	Survey within wetland; map locations of invasive species	2.5			
	Nightshade	Grub out/remove dense patches	Within wetland	0.5	21.5	$6,708	
	Butterfly Bush	Grub out	Two plants found and grubbed out	0.2			
	Blackberry	Grub out thickets, individual plants	Within wetland	0.5	27	$8,424	

Year	Focus	Restoration Work	Notes	Staff Person Days	Contractor Person Days	Contractor Cost	Volunteer Person Days
2011	Knotweed	Remove fabric	Remove ~14,700 ft^2 of fabric installed in 2004 along decommissioned road and haul out most of old fabric.	3.5	8.5	$1,750	
	Knotweed	Herbicide treatment	Treat 685 small isolated stems with targeted backpack spray	0.5			
	Planting	Plant native species	Plant 89 trees along decommissioned road where fabric had been removed	0.5	0.5	$170	
	Blackberry	Survey	During amphibian egg mass surveys	1			
	Blackberry	Grub out individuals	Along decommissioned road	0.5	2	$437	
2012	Knotweed	Remove fabric	Remove 5,530 ft^2 of fabric installed in 2006 & 2007 on large patches within wetland	1	4	$875	
	Knotweed	Herbicide treatment	Treat small isolated stems with targeted backpack spray	0.5	3	$700	
	Blackberry	Survey	During amphibian egg mass surveys	1			
	Blackberry and Nightshade	Grub out thickets, matting patches	Within wetland, from 40 Road	0.5	6	$1,300	
2013	Knotweed	Herbicide treatment	Treat small isolated stems with targeted backpack spray	1			
	Target Invasive Species	Survey	Survey within wetland	9			
	Blackberry and Nightshade	Grub out	Within wetland near beaver dam, from 40 Road	0.5	9	$1,750	
2014	Knotweed	Remove fabric	Remove all remaining fabric, clear trail.	0.5	4	$875	
	Knotweed	Herbicide treatment	Treat small isolated stems with targeted backpack spray	0.6			

Year	Focus	Restoration Work	Notes	Staff Person Days	Contractor Person Days	Contractor Cost	Volunteer Person Days
2014 (cont)	Blackberry & Nightshade	Grub out individuals, thickets	Within wetland, from 40 Road	0.5	20	$3,500	
	Target Invasive Species	Survey	For RCG near 16 roadbed	0.5			
	Reed Canary Grass	Survey	Wetland areas near 16 roadbed from10 Road	0.5			
	Reed Canary Grass	Install fabric	RCG sites 1,2,3,4	1	21	$6,200	
	Planting	Plant native species	Plant 3550 native shrubs & 875 native trees in RCG sites 1,2,3,4 and along roadbed. Cost includes plant purchase.	1	15	$10,025	
2015	Knotweed	Herbicide treatment	Treat small isolated stems with targeted backpack spray	1			
	Planting	Plant native species	Plant 271 native trees and 510 native shrubs in RCG sites 3&4. Cost includes plant purchase.	1.5	10	$4,000	
2016	Knotweed	Herbicide treatment	Treat small isolated stems with targeted backpack spray	1			
	Reed Canary Grass	Clear off fabric	RCG site 4	0.5	22	$6,270	
2017	Knotweed	Herbicide treatment	Treat small isolated stems with targeted backpack spray	1			
	Blackberry	Re-grub thickets	Within wetland, from 40 Road	0.5	21	$6,264	
	Reed Canary Grass	Clear off fabric	RCG site 4	0.5	92	$27,942	

	Planting	Plant native species	Plant 525 understory trees and shrubs in RCG site 4. Cost includes plant purchase.	1	4	$1,500	
Grand Totals				**118**	**466.5**	**$135,320**	**61**