Biological Weed Control
at the Sherwood, Washington, Disposal Site

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The Sherwood, Washington, Disposal Site is located approximately 7.5 miles southwest of the town of Wellpinit in Stevens County. The site is approximately 35 miles northwest of Spokane. Mill decommissioning activities were completed in 1995; at that time, the disposal site was reclaimed and revegetated with native species. The site is not enclosed with fences, allowing for land use to return to pre-operational use of wildlife habitat.

Significant populations of two noxious weed species, diffuse knapweed (*Centaurea diffusa*) and Dalmatian toadflax (*Linaria dalmatica*), occur throughout and around the Sherwood site. Minor, scattered populations of two other noxious weeds, rush skeletonweed (*Chondrilla juncea*) and common St. Johnswort, (*Hypericum perforatum*) also occur on the site. Neither of these latter two weeds is required to be controlled in the area of the disposal site (July 2004 communication with Stevens County Noxious Weed Control Board Coordinator, S. Winterowd).

The widespread nature and inaccessibility of the diffuse knapweed and Dalmatian toadflax infestations make chemical control difficult, if not impossible. Therefore, a biological control program was initiated in spring 2003 with the release of six species of insects. Three insects targeting Dalmatian toadflax—the stem-boring weevil (*Mecinus janthinus*), toadflax flower-feeding beetle (*Brachypterolus pulicarius*), and toadflax seed weevil (*Gymnetron antirrhini*)—were released, and three insects targeting diffuse knapweed—the blunt knapweed flower weevil (*Larinus obtusus*), lesser flowerhead weevil (*Larinus minutus*), and knapweed root weevil (*Cyphocleonus achates*)—were released. In 2004, DOE and Stevens County weed control personnel released additional *M. janthinus*, *L. obtusus*, and *C. achates* insects. The insects attack the target plants in a number of ways, through external feeding of foliage, internal feeding of seed-producing organs by adults and larvae, and internal mining of central taproots. One more release of insects is scheduled for 2010, if necessary.

To monitor the success of the biological weed control efforts, DOE scientists established ten permanent weed-monitoring (WM) transects during the 2004 inspection according to the approach outlined in *Methodology for Conducting Annual Monitoring of Noxious Weeds at the Sherwood, Washington, Disposal Site* (January 2004). The attached map shows transect locations on the site. Eight of the transects (WM–1 through WM–8) were established in weed-infested areas, and two (WM–9 and WM–10) were established in nonweedy areas. For each of the ten transects, scientists stretched a rope between two metal fence posts placed 200 feet apart (e.g., Figure 1 shows weed transect WM–5 at the site). A weed specialist, using a 1-foot ruler (and placing 1/2 foot on either side of the rope), walked the rope length and identified all noxious weed plants that fell within the 1 foot wide path. If any portion of a live weed plant at any stage of maturity occurred within this path, the plant was counted. Table 1 summarizes the data collected at the ten transects between 2004 and 2007.

The monitoring data indicate that the number of diffuse knapweed plants along the transects has decreased dramatically from 2004 and decreased somewhat from 2006 (primarily in transects WM–8 and WM–10). It is believed that the released insects are responsible for this change, as the scientists found weevils on most of the remaining plants.

Figure 1. Weed Transect WM–5 at the Sherwood, WA, disposal site.

Table 1. Number of Noxious Weed Plants Counted Along Weed Monitoring Transects

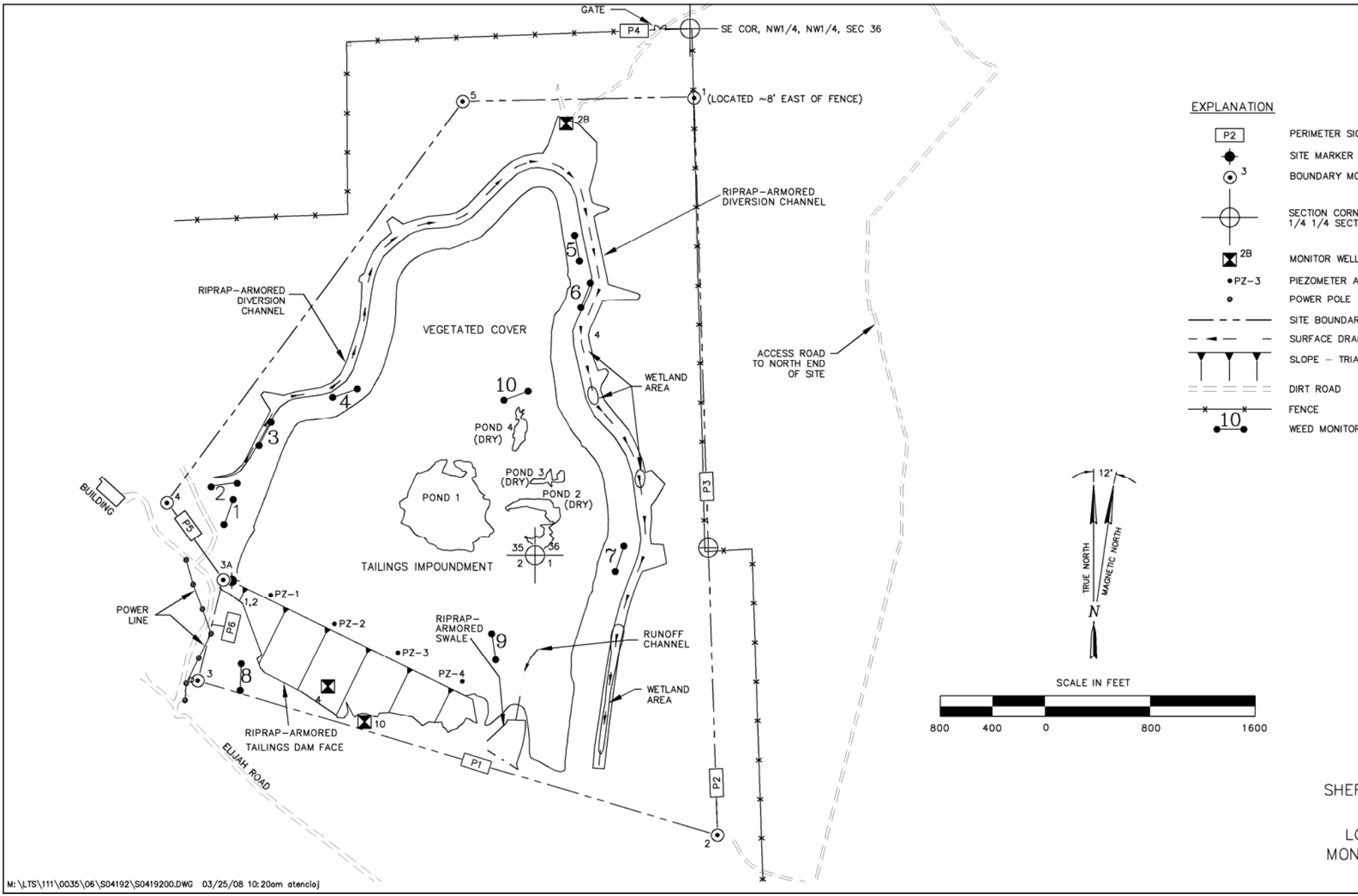
Species	Year	WM–1	WM–2	WM–3	WM–4	WM–5	WM–6	WM–7	WM–8	WM–9	WM–10	Total
Diffuse Knapweed	2004	122	17	177	5	13	29	280	198	0	29	870
	2005	96	14	90	7	31	92	259	140	2	46	777
	2006	68	3	0	2	25	52	1	80	0	54	285
	2007	67	3	13	5	20	55	3	50	0	1	217
Dalmatian Toadflax	2004	11	49	3	90	19	183	29	20	0	0	404
	2005	9	83	1	143	35	195	26	16	0	2	510
	2006	9	104	3	242	36	205	40	79	0	10	728
	2007	7	43	1	216	39	128	29	100	0	0	563
Rush Skeletonweed	2004	1	0	0	2	52	2	0	2	0	0	59
	2005	1	0	0	2	53	5	0	2	0	0	63
	2006	1	0	0	2	71	6	0	9	0	0	89
	2007	2	0	0	2	69	5	0	15	0	0	93
Total of All Weed Species	2004	134	66	180	97	84	214	309	220	0	29	1,333
	2005	106	97	91	152	119	292	285	158	2	48	1,350
	2006	78	107	3	246	132	263	41	168	0	64	1,102
	2007	76	46	14	223	128	188	32	165	0	1	873

In contrast, the number of Dalmatian toadflax plants along the transects steadily increased or stayed about the same from 2004 through 2006. In 2007, however, decreases in plant numbers were observed at transects WM–2, WM–4, WM–6, WM–7, and WM–10, although increases were observed at transects WM–5 and WM–8. Throughout the site, scientists noted that most

Dalmatian toadflax plants were visibly stressed, as indicated by the yellow color of the plants' leaves and stalks (Figure 2). From 95 to 100 percent of the plants along the monitoring transects were determined to be stressed. This stressed condition was caused by either the released insects or recent drought. Over 95 percent of the Dalmatian toadflax plants were small and immature (had not yet flowered) at transects WM–7 and WM–8; overall, plants appeared to be smaller throughout the site. The lack of maturation may have been indicative of the drier and hotter weather this year or a result of insect damage. A period of 5 to 7 years is typically needed before significant changes in Dalmatian toadflax populations occur in response to the introduction of insect controls (personal conversation with Noah Poritz, entomologist at Biological Control of Weeds, August 8, 2006).

Figure 2. Stressed Dalmatian Toadflax Plant.

The number of rush skeletonweed plants along the transects has remained about the same, except for an increase observed at transect WM–8, since monitoring began in 2004. DOE scientists will continue to monitor weed populations along the transects during subsequent years.


GATE
P4
SE COR, NW1/4, NW1/4, SEC 36
(LOCATED ~8' EAST OF FENCE)
RIPRAP-ARMORED DIVERSION CHANNEL
RIPRAP-ARMORED DIVERSION CHANNEL
VEGETATED COVER
ACCESS ROAD TO NORTH END OF SITE
WETLAND AREA
POND 4 (DRY)
POND 3 (DRY)
POND 2 (DRY)
POND 1
TAILINGS IMPOUNDMENT
BUILDING
P5
P6
P3
P2
P1
POWER LINE
PZ-1
PZ-2
PZ-3
PZ-4
RIPRAP-ARMORED SWALE
RUNOFF CHANNEL
WETLAND AREA
RIPRAP-ARMORED TAILINGS DAM FACE
ELIJAH ROAD
EXPLANATION
PERIMETER SIC
SITE MARKER
BOUNDARY MO
SECTION CORN 1/4 1/4 SECT
MONITOR WELL
PIEZOMETER A
POWER POLE
SITE BOUNDAR
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