

Appendix 1A. 2008 Invasive vegetation control at stormwater BMP sites.

INVASIVE VEGETATION CONTROL IN 2008
FOR THE
DELAWARE DEPARTMENT OF TRANSPORTATION
AT
SELECT STORMWATER BEST MANAGEMENT PRACTICE SITES

Agreement #1435: Stormwater Pond Vegetation Control



Prepared by: JCM Environmental Land Management

January 2009

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Introduction

JCM Environmental Land Management (JCM) was retained by the Delaware Department of Transportation (DelDOT) to control select invasive vegetation species growing at stormwater best management practice (BMP) sites throughout Delaware. Invasive vegetation control is to occur over a three year period starting in the year 2008, with JCM to perform targeted and timely applications of appropriate herbicides, make environmental observations of control effectiveness and recommend scientifically-based management actions. This report summarizes invasive vegetation control efforts during calendar year 2008 and makes recommendations to improve future control actions.

Select invasive vegetation species targeted for control consisted of common reed, *Phragmites australis*, cattails, *Typha spp*, and Canada thistle, *Cirsium arvense*. The invasive vegetation species purple loosestrife, *Lythrum salicaria*, and crown vetch, *Coronilla varia* L., were also targeted for control at one BMP location to meet DelDOT management goals for the site. A primary goal of the project is to control the targeted invasive vegetation in an environmentally compatible manner. This includes reducing long-term herbicide use, which was a factor used in selecting herbicides and determining the seasonal timing of herbicide applications.

Herbicide application methods and materials were coordinated with and approved by DelDOT officials to ensure effective results consistent with project goals and with the design, function and management of these stormwater BMPs. DelDOT officials identified the specific BMPs at which herbicide applications were to be performed.

Summary of Herbicide Applications

Herbicides were selected that would provide effective control of targeted invasive vegetation, but that also had minimal environmental impacts. The most effective herbicides were not used if there were more environmentally compatible herbicides that still provided acceptable control of the target invasive vegetation species. Environmental impact factors considered in selecting herbicides included:

- Minimal chemical residual “half-life.”
- Limited or no soil mobility.
- Selective to the targeted vegetation species, when possible, resulting in use of a broad-leaf selective herbicide to control Canada thistle that will not adversely impact vegetation other than broad-leaf plant species.
- Use of only aquatic labeled herbicides, including for upland Canada thistle control due to the potential for drift into nearby associated aquatic BMPs.

Herbicide applications were seasonally timed to minimize environmental impacts by applying herbicides when they provide the most effective control; this approach will minimize the frequency of herbicide applications and hence the amount of herbicides applied. Herbicide applications to Canada thistle were generally performed from mid-May to mid-June before these plants developed to the seed production stage, thereby minimizing additional spread of Canada thistle through seed distribution. Herbicide applications to common reed and cattails were performed during the August through mid-October time period when these plants were physiologically most vulnerable to herbicide applications (note that cattails are vulnerable earlier in the year, but treatment of cattails was delayed to the time period when common reed was most vulnerable to herbicide application to increase efficiency and lower project costs since many sites were vegetated by both species).

Herbicides were mixed and applied in accordance with product label directions by JCM Environmental Land Management personnel possessing the appropriate Delaware Department of Agriculture pesticide application certification(s). Herbicide applications were made using calibrated ground-based and helicopter pesticide application equipment as indicated later in this report. Helicopter herbicide applications were subcontracted to Helicopter Applicators, Inc. from Gettysburg, Pennsylvania and directed by JCM Environmental Land Management personnel.

Efforts were made at each stormwater BMP location to treat as much of the targeted invasive vegetation as practicable. Herbicide applications were also made in such a manner so as to minimize collateral damage to adjacent, desirable vegetation, with such applications utilizing herbicide type and herbicide application equipment to minimize such collateral damage; weather conditions were also considered during applications to minimize collateral damage to adjacent vegetation (and to comply with weather related label restrictions). It should be noted that such collateral damage can not be totally avoided, and at times such damage is necessary to control and prevent aggressive invasive plants from expanding and eventually displacing adjacent, desirable vegetation or aquatic areas. Professional judgment was utilized to determine when to apply herbicides to invasive plants by balancing the risk for collateral damage to adjacent, desirable vegetation with the need to control and prevent the spread of the targeted invasive vegetation.

The following herbicides were applied to the indicated targeted invasive vegetation at the indicated concentrations, with all herbicides and application rates labeled for application to the targeted vegetation:

- **Garlon 3A** (triclopyr) mixed with the spray adjuvant **LI 700** (phosphatidylcholine, methylacetic acid and alkyl polyoxyethylene ether). Applied with **ground-based equipment** as a 4% Garlon 3A/0.5% LI 700 mixture to control **Canada thistle** (also applied to purple loosestrife and crown vetch at BMP #195). Garlon 3A is a broad-leaf selective herbicide.
- **Rodeo** (glyphosate) mixed with the spray adjuvant **Cygnat Plus** (alkyl hydroxypolyoxyethylene and d, l-limonene). Applied with **ground-based equipment** as a 0.75% Rodeo/0.5% Cygnat Plus mixture to control **cattails and common reed**. Rodeo is a non-selective, broad spectrum herbicide.

- **Rodeo** (glyphosate) mixed with the spray adjuvant **LI 700** (phosphatidylcholine, methylacetic acid and alkyl polyoxyethylene ether). Applied **aerially** with a helicopter at select sites at a rate of 6.0 pints Rodeo/0.6 pints LI 700 per acre to control **cattails and common reed**. Rodeo is a non-selective, broad spectrum herbicide.
- **Habitat** (imazipyr) mixed with the spray adjuvant **MSO Concentrate** (methylated vegetable oil, alcohol ethoxylate and phosphatidylcholine). Applied with **ground-based equipment** to select site(s) as a 1.5% Habitat/1% MSO mixture to control **cattails and common reed**. Habitat is a non-selective, broad spectrum herbicide.

Herbicide application data including treated vegetation species, herbicide mixing and application quantities, application dates and times and weather data were recorded for all herbicide applications. These herbicide application data sheets are retained on file and digital copies will be provided to DelDOT in early 2009.

A summary of herbicide application dates and targeted invasive plant species at each BMP is presented in this report's corresponding spreadsheet entitled "Summary of JCM Environmental 2008 Herbicide Applications to DelDOT Stormwater Pond Vegetation under Agreement #1435."

Note that targeted invasive vegetation, primarily cattails, in some BMPs was dormant during the latter part of the 2008 spray season due to drought conditions. This prevented herbicide application to these invasive vegetation stands since dormant vegetation is not effectively controlled by herbicides (vegetation must be actively growing to be controlled by topical herbicide application).

Total *statewide* quantities of each herbicide and adjuvant applied to these BMPs during the year 2008:

- **Garlon 3A -- 6.21 gallons** (herbicide applied to Canada thistle; also applied to purple loosestrife and crown vetch at BMP #195)
- **Rodeo -- 9.46 gallons** (herbicide applied to common reed and cattails)
- **Habitat -- 0.11 gallon** (herbicide applied to common reed and cattails)
- **LI 700 -- 1.10 gallons** (adjuvant mixed with Garlon 3A and Rodeo)
- **Cygnat Plus -- 4.30 gallons** (adjuvant mixed with Rodeo)
- **MSO -- 0.08 gallon** (adjuvant mixed with Habitat).

Quantities *by county* of each herbicide and adjuvant applied to these BMPs during the year 2008 (in gallons):

<u>Herbicide/adjuvant</u>	<u>New</u>			<u>Total</u>
	<u>Castle</u>	<u>Kent</u>	<u>Sussex</u>	
Garlon 3A	5.34	0.86	0.01	6.21
Rodeo	6.80	2.32	0.34	9.46
Habitat	0.11	--	--	0.11
LI 700	0.89	0.20	0.01	1.10
Cygnat Plus	3.22	0.86	0.22	4.30
MSO	0.08	--	--	0.08

Efficacy Observations

Qualitative, anecdotal evaluations of herbicide application effectiveness on treated invasive vegetation were informally performed at a few sites in the course of traveling to or treating other BMPs. Findings generally indicted effective control of treated invasive vegetation. More quantitative and formal herbicide efficacy monitoring should be considered in the future (see Discussion and Recommendations section of this report).

Discussion and Recommendations

Control of targeted invasive plant species was successful in this first year of the program. Several coordination and technical deficiencies were identified and program improvements should be considered as further outlined below, some of which have been addressed with DeIDOT and certain corrective actions already indentified and/or initiated. Additional recommendations are also presented to improve efficiency and vegetation control while reducing herbicide use over time.

The primary coordination deficiencies indentified and in need of improvement include (*status or suggested actions indicated in italics*):

- Clarification of and development of criteria identifying spray boundary limits in consideration of (*these items were addressed and resolved during the 2008 spray season with the development of clear field decision criteria*):
 - boundaries between BMP spray areas and adjoining right-of way spray areas
 - limits of spray boundaries within BMPs.
- Mowing of targeted invasive vegetation, particularly Canada thistle, by DeIDOT maintenance crews soon before the site is scheduled to be sprayed. This results in difficulty in locating or not being able to locate the targeted vegetation, and also results in substantially reducing the plant surface area to be sprayed which theoretically reduces herbicide efficacy. (*Suggested solution is to coordinate BMP vegetation control program with local DeIDOT maintenance crews such that these areas are not mowed until at least two weeks after herbicide application.*)
- Targeted invasive vegetation listed in the DeIDOT BMP survey site documents/maps that served as the basis to direct herbicide applications often grossly under- or over-estimated the areal coverage of invasive vegetation cover. This compromised planning logistics and resulted in JCM field staff questioning the extent of herbicide application boundary limits and whether the BMP location was correct. The cause of this deficiency is unknown, but could include field survey error/quantification or expansion/contraction of vegetation communities between the time of field survey and herbicide application. (*This item was addressed and partially resolved during the 2008 spray season, with future solutions including cross-training between project subcontractors in plant identification and survey/mapping methods, improved communication involving immediate reporting of observed mapping or vegetation presence/quantification errors and monthly reporting of where herbicides were applied; also includes developing protocol for handling discrepancies between previously surveyed/reported and actual real-time areal coverage of targeted vegetation.*)

- Individual BMP site maps provided by DelDOT occasionally contained errors on BMP location. This compromised efficiency in locating the BMP or resulted in not being able to find the BMP. *(This item was addressed and partially resolved during the 2008 spray season, with additional corrective actions planned such as improved subcontractor quality control in mapping BMP locations and the addition of ADC map grid # and GPS coordinates on future maps).*
- Access to a few BMPs was not possible due to fences and not being able to find any access gates. *(This item is being addressed through identification of those BMPs where access was/is restricted, locating any access gates that may be obscured by vegetation and otherwise resolving the access issue.)*

The primary technical deficiencies identified and in need of improvement include *(status or suggested actions indicated in italics)*:

- Develop and implement a methodology to quantifiably evaluate herbicide and other control action effectiveness. This effort should expand the qualitative, anecdotal efficacy assessment performed in 2008, and should include assessment of non-target vegetation impacts. *(Needs to be developed and implemented before the start of the 2009 spray season, and should include qualification and documentation of short-term direct vegetation mortality and tracking of longer-term areal coverage trends of targeted invasive vegetation species.)*
- Consideration should be given to improving herbicide application coverage through the addition of a “marker” dye to herbicide mixtures. *(While no specific major herbicide application problems were observed through the qualitative, anecdotal efficacy assessments, increased herbicide application coverage and efficiency would likely be achieved through use of such a marker dye. This improvement should be considered and further researched before the start of the 2009 spray season to determine if such a dye is fully compatible with and will not reduce the effectiveness of utilized herbicides.)*

A broader Integrated Pest Management (IPM) plan should be developed for long-term control and management of the targeted invasive vegetation species. This IPM plan should, in addition to utilizing targeted and selective herbicide applications, identify and incorporate additional vegetation management control actions that supplement herbicide applications. The goal of this IPM plan should be to achieve the desired control of the targeted invasive vegetation species while lowering long-term herbicide use and the financial cost of the vegetation control program. Specific components of this IPM plan should include at the minimum:

- Surveying and quantifying the distribution and abundance of the targeted invasive vegetation species.
- Development of specific invasive vegetation abundance thresholds that determine when herbicides should be applied.
- Evaluation and identification of available site management or maintenance practices that can prevent or minimize the abundance of the invasive vegetation species. These should include physical management practices such as mowing, cutting or burning of vegetation *after* herbicide treatment. The purpose and timing of such vegetation removal practices varies by species, the specifics of which should be addressed in the IPM plan.

- Periodic review of herbicides used, selecting any new or existing herbicides that provide the desired control of the targeted vegetation and that are cost-effective, environmentally compatible and, when possible, selective to the general targeted vegetation type.
- Evaluation whether control actions are resulting in unacceptable impacts to non-target, desirable vegetation species.
- A specific pesticide reduction strategy based on integrated use of the other IPM plan components.
- Periodic evaluation of invasive vegetation prevention and control efforts and of new technologies.

Collective implementation of the above recommendations should result in a cost-effective and environmentally-compatible invasive vegetation control program that minimizes and reduces herbicide use.