COMMONWEALTH of VIRGINIA

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June 19, 2019

Mr. Michael Liberati
Corteva Agriscience
Agriculture Division of DowDuPont
Chestnut Run Plaza 715-236
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VIA ELECTRONIC MAIL

Re: Japanese Knotweed Treatment Pilot – Summary of Results
Area of Concern 4, Former DuPont Waynesboro Plant
Waynesboro, Virginia
EPA ID# VAD003114832

Dear Mr. Liberati:

This letter acknowledges the receipt and review of the Japanese Knotweed Treatment Pilot – Summary of Results dated April 17, 2019, submitted to the Virginia Department of Environmental Quality, Office of Remediation Programs (Department) by AECOM on behalf of the E.I du Pont de Nemours and Company (DuPont, now Corteva).

The Department has no comments on the memorandum except that Corteva may want to continue to monitor the results of the City of Waynesboro's efforts to control the Japanese Knotweed as the herbicide they use is selective and thus may be reduce Corteva's maintenance on future bank management areas where knotweed is present and use of a herbicide is required.

If you have any questions, you may contact me at 703-583-3825 or by email at Kurt.Kochan@deq.virginia.gov.

Sincerely,

Kurt W. Kochan
Corrective Action Project Manager

cc: DuPont Waynesboro Correspondence File
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Project name:
DuPont South River - AOC 4

Project ref:
60559685

To:
Michael Liberati
DuPont Corporate Remediation Group

CC:
Ceil Mancini - AECOM

From:
Joshua Collins – AECOM
Scott Gregory - AECOM

Date:
April 17, 2019

Technical Memorandum

Subject: Japanese Knotweed Treatment Pilot – Summary of Results
Former DuPont Former Waynesboro Site – Area of Concern 4

Background

Japanese knotweed (knotweed; *Fallopia japonica*) is a persistent invasive plant, forming monotypic stands on large stretches of river banks of the South River, Virginia. Prior to implementation of the Constitution Park Bank Management Area (BMA) Interim Measures, pre-stabilization percent cover of knotweed in the herbaceous layer along the BMA ranged from 60% to 80% (AECOM 2016 and 2017). Following completion of the Interim Measures in February 2017, vegetative cover rapidly recolonized the newly restored bank, quickly reaching close to 100% cover and negatively impacted the native plantings included in the Interim Measures restoration design.

Post stabilization knotweed management strategies included three rounds of cutting and removal, and two rounds of foliar application of a glyphosate herbicide from June through September, 2017. While this approach slowed knotweed growth, native vegetation planted at the BMA following completion of the Interim Measures was also negatively impacted by spray drift from the herbicide application.

A pilot herbicide application approach to knotweed management (Knotweed Pilot) was conducted during summer and fall 2018 at the Constitution Park BMA to assess and identify effective knotweed management strategies that would also be protective of desirable plant species. Due to the invasive nature of knotweed, management strategies along the South River must account for:

- Aggressive growth and reproductive strategies of the plant;
- Rapid recolonization from adjacent areas; and
- The presence nearby, of extensive monoculture stands.

Coordinated invasive species management efforts at a broader scale often show better results (Williams, 2015). To that end, a primary objective of the Knotweed Pilot is to share management approaches, data, and key learnings with local agencies and organizations within the South River watershed to facilitate invasive species management at a larger scale. In 2017, the City of Waynesboro established a Japanese knotweed management plan to address the growth of the invasive plant along the South River Greenway (Greenway; City of Waynesboro, 2017). Two foliar herbicide applications were conducted in the Summer/Fall 2017 along the Greenway, between the Main Street and Broad Street Bridges; additional

herbicide applications and mechanical removal, were conducted in 2018 which successfully reduced the extent and vigor of knotweed within this reach.

This technical memorandum outlines the approach, methods, presents results, and provides a discussion of the Knotweed Pilot, which will serve to guide future invasive species management actions at Constitution Park and other BMAs.

Approach

The Knotweed Pilot was conducted on the left descending bank of the South River, just upstream of the Constitution Park BMA in an area with extensive knotweed growth (Figure 1). Two treatment areas (approximately 64 meter^2 each) were established with five one-meter^2 test plots per treatment area. Test plots were also established downstream of the Main Street bridge to compare results of the City of Waynesboro's knotweed management program.

The Knotweed Pilot tested two herbicide application approaches; foliar application (i.e. spraying) and stem injection. Within each treatment type (i.e. spraying or stem injection), one half of the treatment area had all knotweed stems cut and removed six weeks prior to herbicide application to evaluate if pre-treatment clearing:

1) Enhances herbicide treatments to be more effective at killing knotweed; or
2) Facilitates administration of knotweed injections.

The study design for the Knotweed Pilot is summarized in the following table:

Herbicide Treatment Type	Pre-treatment Cutting/Removal
1 – Stem injection	Cut/Removed
	None
2 – Foliar Application	Cut/Removed
	None

Methods

An initial characterization of knotweed density was performed on April 30, 2018, followed by a combination of knotweed management treatments as outlined below.

Stem density. Pre-treatment knotweed stem densities were characterized within each treatment area to serve as a basis for comparison with Post-treatment densities as a measure of success. Pre-treatment stem densities were measured at each of five, one-meter^2 test plots per 25'x25' treatment area prior to herbicide application to establish baseline conditions (Figure 1). Test plots were established by setting a wooden stake in the upper left corner of each test plot. A one-meter^2 PVC grid was placed over the stake to establish the assessment area. All stems of knotweed within the test plot were counted, and the typical stem height was documented on field datasheets. A typical stem height was considered qualitatively by visual estimation of the overall height of the stand. Post-treatment stem densities were evaluated at the same test plots established during the baseline assessment. Photo documentation of each treatment area was performed from the top and bottom of the bank to facilitate qualitative comparisons of pre- and post-treatment knotweed condition.

Knotweed Cutting/Removal. Manual cutting and removal of knotweed cuttings prior to herbicide application were conducted at designated test plots using hand tools during the week of May 14, 2018 (Figure 1). The stems were cut just above the ground surface using loppers. All cuttings were carefully

bagged and removed from the site and disposed of at the local landfill to prevent re-establishment of the cuttings into new plants.

Herbicide Application. Herbicide applications were performed by Virginia licensed applicators during the week of June 25, 2018 as described below:

- Stem Injection - Knotweed stems within the designated treatment areas were injected with approximately 4-5 milliliters (ml) of a concentrated glyphosate herbicide solution of Rodeo below the third node of the stem, using a JK Injection Systems™ stem injector.

- Foliar application was accomplished by spraying a 5% Rodeo™ with a surfactant following manufacturer recommendations and standard application techniques.

Results and Discussion

The Knotweed Pilot results indicate that all herbicide treatment types and cutting/clearing regimes were equally effective at controlling existing stands of knotweed. Average pre-treatment live stem densities ranged from 48 stems/m^2 at stem injection test plots, to 39 stems/m^2 at foliar application test plots (Table 1). All knotweed plants within the Knotweed Pilot test plots were dead by the time of the fall post-treatment monitoring event. Typical post-treatment knotweed stem heights at stem injection test plots (Mean = 4.8 feet) was nearly double that of those at Foliar application plots (Mean = 2.65 feet). Similar stem heights (Mean = 2.6 feet) were observed at areas receiving foliar glyphosate applications as part of the City of Waynesboro knotweed management program. Of note, typical knotweed stem heights were similar between areas that were cut before treatment, and those that were not cut at all.

Table 1: Live Stem Density

Live Stem Density of Test Plots				
Treatment Type	Pre-Treatment		Post-Treatment	
	Average Knotweed Density (# stems/m^2)	Typical Stem Height (ft)	Average Knotweed Density (# stems/m^2)	Typical Stem Height (ft)
Cut and Stem Injection	44	3	0	5
Stem Injection Only	52	2.8	0	4.6
Cut and Foliar Application	49	2.5	0	2.3
Foliar Application Only	35	2.7	0	3
City of Waynesboro Management Program	40	2.3	25	2.6

The knotweed pilot identified several advantages and disadvantages of each approach evaluated.

Stem injection techniques showed promise for treating relatively small stands of knotweed in areas where foliar application techniques would be less desirable (e.g. in close proximity to established native vegetation). However, for stem injection to be successful, the knotweed must achieve a stem diameter of approximately ¾" inches, allowing it to mature, grow taller, and potentially shade out or otherwise outcompete, immature native species. Stem injection is a very labor intensive and tedious process that would not be cost effective at treating large stands of knotweed.

Foliar application knotweed treatment techniques are much quicker and cost effective, and allow multiple treatments to be made throughout the growing season, limiting overall stem height. Spray drift is an

unintended consequence of foliar application techniques that can result in elimination of proximal, desirable species.

While not considered in this Pilot Study, the use of alternate species-specific herbicides may also be beneficial. The City of Waynesboro is planning to use Garlon 3a for on-going treatment of knotweed stands along the Greenway where they have been reduced over the past few years. The advantage of Garlon 3a, is that it is a selective herbicide that permits growth of native grass species that can provide soil stabilization along the bank and further limit the spread of knotweed.

The Knotweed Pilot is complete, with no further activities planned at this time. The key findings of the Knotweed Pilot outlined below will be used to guide knotweed management practices at the Constitution Park and other BMAs as the Phase 1 IMs progress. In summary,

- A combination of treatment approaches is necessary to effectively control the highly invasive Japanese knotweed at South River BMAs.
- Pre-remediation foliar herbicide application as used at the Allied Ready Mix BMA, can be useful to reduce knotweed density and health prior to BMA remediation; this strategy in turn, may reduce knotweed recolonization following site restoration.
- Stem injection is effective in small patches of knotweed to limit spread, without impacting surrounding vegetation.
- Multi-year combination strategies are necessary where extensive stands of Japanese Knotweed are present prior to remediation; until the native vegetation community can mature and begin to shade out, and out-compete knotweed.
- The use of species-specific alternative herbicides and other treatment techniques such as hand-wicking should also be considered in an integrated strategy as warranted.

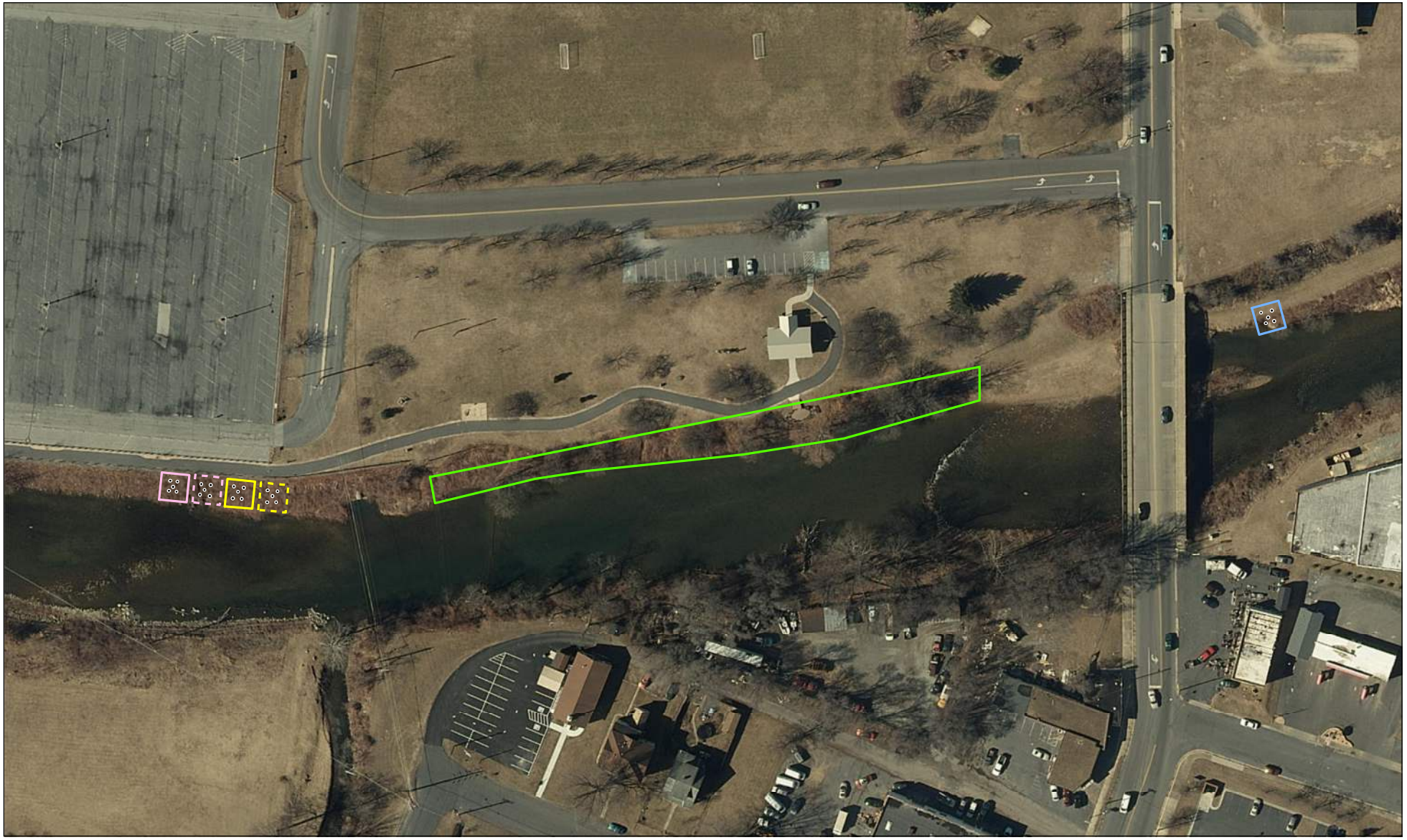
References

AECOM. 2017. *2016 Short-Term Monitoring Report*. Former DuPont Waynesboro Site, Virginia. Prepared by AECOM. June 2017.

AECOM. 2016. *Area of Concern (AOC) 4 2015 Short-Term Monitoring Report*. Former DuPont Waynesboro Site, Virginia. Prepared by AECOM. October 2016.

City of Waynesboro. 2017. Japanese Knotweed Management Plan

Williams, Robert K. 2015. Managing Japanese Knotweed (*Fallopia japonica*) In the Salmon River and Salmon River Estuary. Final Project Report. SLELO PRISM. Grant I.D. 1320183823 c/o. The Nature Conservancy, CWNY. 269 Ouderkirk Road. Pulaski, NY 13142.



Legend

- BMA Treatment
- Treatment 1 - Stem Injection
- Treatment 2 - Foliar Application
- Treatment 3 - City of Waynesboro
- Test Plots
- Treatment 1 - Area To Be Cut
- Treatment 2 - Area To Be Cut

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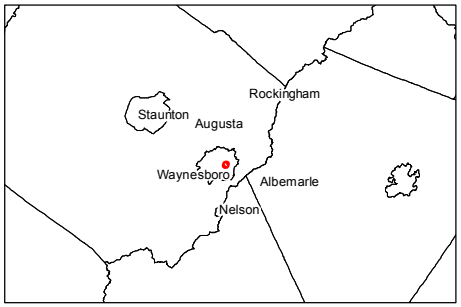
Reference:
NAD 1983 StatePlane Virginia North
Projection: Transverse Mercator
Linear Unit: Foot US

0 50 100 200 Feet



AECOM

Figure 1
Site Location Map
Knotweed Pilot

Area of Concern (AOC) 4
Former DuPont Waynesboro Site
Waynesboro, Virginia

Prepared by: CDW	Checked by: JC
Job:	Date: 3/16/2018

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