WDFW Reply to Ecology on Invasive Cattail Control

From:	Heimer, David M (DFW)
Sent:	Tuesday, October 08, 2013 12:37 PM
To:	Anderson, Paul S. (ECY)
Cc:	SEPADesk (DFW); Williams, Brian W (DFW); Rotton, Belinda (DFW)
Subject:	Invasive Cattail Control Project SEPA Response

Paul,

Thank you for reviewing our Invasive Cattail Control Project. In response to your comments, we feel that it is prudent to reduce the acreage of our project to 65 acres over the four years and increase our monitoring of the treatment response over time and tidal ranges. By reducing the scale of the project we hope to address your concerns regarding undesired outcomes and still fulfill our need to move the project forward at a scale that is meaningful for our land management responsibilities.

I have responded to the comments in your letter based on the original scale (650 acres) of the project. Please take into account the scale of the project has been reduced by 90% when reading them.

Comment 1: What is the overall project objective and what is the environmental issue the project is hoping to address? While *T. angustifolia* is considered an invasive species, more information needs to be provided on the recent spread of *T. angustifolia* at the project site. Analysis of shoreline aerial photographs back to the 1970s indicate that cattail has been present at the Skagit Wildlife Area for decades and it is unclear how its distribution has changed in recent years.

Response: The three objectives of this project are to:

1. Prevent dominant stands of invasive cattail from developing in uninfested and or newly restored areas by surveying the wildlife area regularly and identifying colonizing infestations of invasive cattail.
2. Control colonizing/pioneering infestations of invasive cattail quickly when they're discovered, to improve treatment efficacy, reduce cattail expansion and preserve or encourage native habitat and processes.
3. Develop an effective and systematic management approach to control or manage large meadows of invasive cattail and allowing those areas to transition to more diverse native vegetation.

Accomplishing these objectives we hope will improve the habitat function and value in salmon restoration projects on the wildlife area and provide a more diverse habitat for waterfowl and shorebirds and improve the development of native plant communities.

Yes, cattail was present in the '70s. Unfortunately, evidence of non-native cattail invasiveness has been demonstrated by their aggressive colonization of restoration projects on the wildlife area where diked farmlands have been opened to tidal inundation. In addition, the scientific literature indicates that *T. angustifolia*, *T.* x *glauca* and related hybrids are invasive.

Comment 2: What ecological functions (fish and wildlife habitat, nutrient input, water quality, hydrology/hydraulics) are currently impacted either beneficially or adversely, by the presence of *T.*

***angustifolia* and what effect will removal have on those functions? The extensive cattail marshes along the Skagit Bay shoreline are providing some habitat benefit and benefit coastal processes by attenuating wave energy and coastal erosion.**

Response: Invasive *Typha* species represent a threat to Washington through displacing native plants, through changing the genetic profile of native *Typha* stands, and through altering how organisms use marsh habitat. Non-native *Typha* species and hybrids can also be a serious problem in irrigated agricultural and managed aquatic systems. The following information on the ecological impacts of invasive cattail is taken from the State Noxious Weed Control Board's written findings (http://www.nwcb.wa.gov/whatsNew.html):

Invasive *Typha* are capable of displacing native plants because of their tolerance to deeper water and to more saline conditions. Higher tolerance to depth and salinity means that the potential range that invasive *Typha* are capable occupying is much greater than the current distribution of *T. latifolia*. When competing with *T. angustifolia*, *T. latifolia* was restricted to shallower zones and could grow no deeper than about 37 cm (Grace and Wetzel 1998), while *T. angustifolia* could grow to depths greater than 100 cm (Grace and Wetzel 1982; Inoue and Tsuchiya 2009). Similarly, *T. domingensis* had a maximum depth of 150 cm (Grace 1987) and is invasive in brackish wetlands even in its native range (Smith 2000). The growth of invasive *Typha* into deeper habitats and their creation of very dense, monotypic stands can reduce, or eliminate emergent and submerged native plants through shading and resource competition. In a study by Selbo and Snow (2004), *T. angustifolia* was fifteen times more abundant that *T. latifolia*.

Allelopathy, through root exudates, may be a mechanism that confers a competitive advantage to *T. angustifolia* (Jarchow and Cook 2009). Roots exudates of *T. angustifolia* had an effect in greenhouse tests on river bulrush, *Bolboschoenus fluviatilis*, reducing longest leaf length, ramet number and biomass when activated carbon was not present (Jarchow and Cook 2009). Gallardo et al. (1998) found that aqueous extracts of *T. domingensis* were found to inhibit the growth of common water fern, *Salvinia minima*, with the root extracts being the most inhibitory.

In addition, in litter experiments *T. x glauca* was shown to outperform native plants in the uptake of nitrogen (Larkin et al. 2012). The net effect of this nutrient competiveness over multiple seasonal studies could be to move nitrogen away from native species into living and dead *T. x glauca* biomass (Larkin et al. 2012). Vaccaro et al. (2009) also found a reduction in non-*Typha* species density and seedling survival with an increase in *Typha* litter. While clonal species studied were not affected by the *Typha* litter, annual or non-clonal herbaceous plants with less below ground storage did not survive in cattail litter additions and could be vulnerable to accumulation of litter, causing a reduction in plant diversity.

The potential hybridization by invasive *Typha* threatens the genetic integrity of native *T. latifolia* marshes. Both *T. angustifolia* and *T. domingensis* have the ability to hybridize with *T. latifolia*. Since 1888, *T. x glauca* has been recognized as an interspecific hybrid in Europe (Smith 1987 as cited in Galatowitsch et al. 1999). *Typha x glauca* is more competitive than either parent (McDonald 1955; Grace and Wetzel 1981, 1982 a & b; Smith 1987; Waters and Shay 1990, 1992 as cited in Galatowitsch et al. 1999) which can lead to a replacement of *T. latifolia*. Backcrosses by the F_1 generation (Snow et al. 2010) can further alter the genetic diversity of native *Typha latifolia* populations making identification and conservation of these populations difficult. A similar situation occurred when the invasive *Spartina alterniflora* hybridized with the native *Spartina foliosa* in San Francisco Bay (Daehler and Strong 1997) making identification and control difficult. *Typha domingensis* will hybridize with *T. latifolia* (sometimes called *T. x provincialis*), with progeny that are usually sterile, though F2 plants are known from California. *Typha angustifolia* and *T. domingensis* hybridize to form fertile offspring. Trihybrids of *T. latifolia* x *T. angustifolia* x *T. domingensis* are common in parts of California (Smith 2000). The hybrids *T.* x *glauca* and *T. latifolia* x *T. domingensis* are both present in Washington.

Once established, invasive *Typha* change higher trophic level dynamics in the marsh. For example, microalgal densities were found to be even lower on *T. angustifolia* than on *Phragmites* in a freshwater wetland, possibly due to allelopathic leachates (Kulesza et al. 2008). In a study on amphibians, Maerz et al. (2010) found that treatments containing plant detritus with high C:N (i.e. *Typha angustifolia*) resulted in poor metamorph production and performance. In addition, ducks tend to avoid wetlands with monotypic vegetation like hybrid cattail. This is likely due to reduced abundance of shallow aquatic plants and their associated invertebrates, which female ducks and their young feed on (Kantrud 1992). Similarly, Hood (2013) found that ducks utilized sites where *T. angustifolia* had been removed and replaced by *Carex lyngbyei*, but not the *T. angustifolia*-dominated control site.

Non-native *Typha* species and hybrids can present a serious problem in irrigated agricultural lands and managed aquatic systems (National Academy of Sciences-National Research Council 1976 in Grace and Harrison 1986). While being especially troublesome in rice fields (Muenscher 1955 in Grace and Harrison 1986), *Typha* species can invade irrigation canals, farm ponds, and drainage ditches, impeding water flow and increasing siltation (Grace and Harrison 1986). Also, *Typha* stands, primarily of *T.* x *glauca*, that were near sunflower fields in North Dakota provided roosting sites for birds that damaged crops before harvest (Ralston 2004). Swimming, boating, fishing and other recreational activities can also be impacted by the invasion of *Typha*. Reservoirs in Canada and the western United States have also been impacted by *Typha's* rapid invasion of sandbars and influence on siltation rates (Fletcher and Elmendork 1955 and Hallock 1973 in Grace and Harrison 1986).

Typha species also have a high growth rate that allows it to establish and produce a high quantity of biomass in a short period of time. *Typha* productivity and growth rates have been quantified in Indiana (Apfelbaum et al. 1983, Wilcox, Apfelbaum, and Heibert 1984). Apfelbaum (1985) reports that based on dry weight, cattails contributed 700 kilograms (1543 pounds) of biomass per hectare (approx. 600 lbs/acre) where it grew in monocultures. Estimates made from aerial photographs showed growth increased from 2 to 37.5 hectares (5-93acres) from 1938 to 1982. This study also confirmed declines in sedge-grass and prairie meadow vegetation as cattail increased (Apfelbaum 1985). At Horicon Marsh in Wisconsin, *Typha* monocultures increased from 30 to 80 percent cover from 1947 to 1971 and associated vegetation declined (Linde 1963, Bedford, Zimmerman, and Zimmerman 1974, Wisconsin DNR 1971 in Apfelbaum 1985).

Removing invasive cattail will provide an opportunity for native plants to colonize the treatment area and for the site to transition to a more diverse natural condition. Because the leaf structure of native plants is less robust than invasive cattail, the colonization and utilization by invertebrates is anticipated to be greater, as well as a mobilization of native plant material in the detrital food web.

It is unclear and undocumented whether invasive cattail is providing a habitat benefit and benefitting coastal processes. A more apt description would be that invasive cattail is *changing* habitat and *altering* coastal processes from what they have been historically. To my knowledge, there is no scientific literature which states that invasive cattail increases native plant diversity, or leads to an increase in waterfowl production and use. The fact that invasive cattail grows deeper and may accrete sediment over a greater intertidal area than native cattail does not necessarily represent benefit if it interferes with the ability of Fir Island to drain.

Comment 3: Has WDFW assessed the potential impacts of cattail removal on water quality and coastal erosion?

Response: Invasive cattail removal is not anticipated to affect water quality, or coastal erosion for the following reasons:

1. Use of the Marshmaster to crush invasive cattail will occur during low tides eliminating turbidity issues.
2. Crushed cattail will be left in place, creating a layer that will reduce the potential of erosion and suspended sediment.
3. Cattail roots will remain intact and bind sediments.

4. Some cattail resprouting will occur and native vegetation will colonize the site over time. The transition will bind sediment and attenuate wave action.
5. A ten foot standing cattail buffer will be left around crushed site to contain crushed cattail and reduce wave energy and sedimentation.
6. Vegetation outside of the treatment area will be left untreated and attenuate wave action.
7. Impacts to existing tidal marsh channels will be minimized through implementing the best management practices outlined in Comment #4, below.

Comment 4: Does the proposed removal include removal of the cattail roots and rhizomes? Mechanical removal of aboveground growth will likely not be effective in eradicating the cattails since they can resprout from rhizomes. Removal of the roots and rhizomes poses a significant risk to water quality and altering the existing bayfront topography. Has WDFW analyzed the potential water quality impacts from mechanical removal? Has the potential impact to nearshore topography (tidal channels, mudflats and vegetated hummocks) been assessed?

Response: Roots and rhizomes of invasive cattail will not be removed. Some resprouting from rhizomes is anticipated and would be treated in subsequent years using a method appropriate for the site and degree of regrowth. For instance, areas of little regrowth may be spot treated with herbicide, whereas areas of dense regrowth may have to be re-crushed, or cut. During the period that invasive cattail above ground cover is decreasing, we expect the above ground cover of native marsh vegetation to increase. Hummocks and mudflats will be avoided when using mechanical methods when possible. Impacts to existing tidal marsh channels will be minimized through implementing the following best management practices:

1. The Marshmaster will only cross tidal channels that are 4 feet in width or less during low tide cycles when the marsh plain is not flooded.
2. The Marshmaster will only cross tidal channels greater than 4 feet in width during high tide cycles when the marsh plain has sufficient water depth to allow the Marshmaster to operate as a floating vessel.
3. At a minimum, a 10 foot buffer of undisturbed marsh vegetation will be maintained along tidal channels with widths greater than 4 feet.

Comment 5: Which control methods will be used and how has WDFW evaluated which methods are appropriate for a given location. Is herbicide application being proposed throughout the 650-acre control area or only at specific locations and if other control methods are not successful? The annual application of up to 5,000 gallons of aquatic herbicide to intertidal habitat seems like a potentially significant impact that may warrant an environmental impact statement.

Response: Four methods will be used for treating invasive cattail which includes cutting, crushing, herbicide application and passive revegetation from nearby native plants. These methods may be used alone, or in combination to achieve the goal of reducing invasive cattail cover at treatment sites and they are consistent with integrated pest management (IPM) principles.

Using mechanical methods, such as crushing and cutting, to treat monotypic meadows will reduce the cover of invasive cattail, reducing the need for herbicide applications. Herbicide treatments will occur throughout the site, but will be focused on areas of low invasive cattail density and discrete patches (e.g. individual or small patches, fringing infestations) where efficacy is the highest.

The figure of 5,000 gallons per year of mix was used as a worst-case, spray only approach, which we do not intend to implement. It is important to understand that water represents 97% of the 5,000 gallons of mix and that figure is a probably a better estimate for the total needed for the four years of the project. Over the four years of the project, approximately 150 gallons of herbicide will be used which includes: imazapyr (0.75%), glyphosate (1%); Agridex (1%) and a marker dye (0.25%). All of the products used have been approved by EPA, WSDA and Ecology for aquatic applications and will be applied under the NPDES permit for aquatic noxious weeds. Herbicide residue sampling conducted during *Spartina* control showed very little herbicide entered surface waters and the residence times where short. The fact that cattail is 2-3 times as tall as *Spartina* makes is even less likely that tidal inundation will wash herbicide off the plants.

Comment 6: If machinery is used to remove the cattails, has the potential impact to other habitat functions been assessed? Have access routes been designated? How much area (square footage) of non-target vegetation will the cattail mowing/crushing impact? Large pieces of downed wood in the estuary provide important microhabitats and raptor perch sites. What impact will machinery moving through the intertidal marsh have on large woody debris (logs and root wads)?

Response: WDFW is concerned about non-target impacts to native vegetation and large organic debris (LOD). To the extent possible, native vegetation will be avoided by equipment and herbicide applications. We cannot offer a square footage estimate for off-target impacts, although we expect the figure to be small in the cattail meadows. It is important for us to retain as much native vegetation as possible in the treatment areas to facilitate the transition back to native marsh. Preliminary ingress and egress points have been identified with the goal minimizing impacts to vegetation other than invasive cattail.

In most cases, LOD will be avoided and left in place where crushing activity is being implemented. Cattail fringes left around LOD can be either mowed, or treated with herbicide at a later time. To reduce impacts to LOD the following best management practices will be implemented:

1. Existing LOD in tidal channels with widths greater than 4 feet or within the 10 vegetation buffer described above in item 3 will be left undisturbed.
2. Existing LOD outside of the 10 foot vegetation buffer described in item 3 of Tidal Channel BMPs may be set aside to allow crushing activity but will maintain on the marsh plain in the immediate vicinity of its original location.

Comment 7: What will be done with the mown/crushed cattail leaves once they have been cut? Will they be removed for disposal or left in place? If not removed, has WDFW analyzed the potential impact of the plant debris on shoreline functions and processes? The mat of decomposing cattails has the potential to create anoxic conditions in the bay and substrate, potentially impacting aquatic and benthic fauna and ultimately, fish and wildlife.

Response: Invasive cattail that has been mowed and crushed will be left in place and contained by a buffer of standing cattail. This idea is taken from the natural condition of the marsh where large rafts of broken cattail currently exist and are contained *in situ*. Tidal action in Skagit Bay and the movement of freshwater through the site from the Skagit River, it is unlikely that anoxic conditions would develop in treatment areas. Some changes to the sediment conditions may occur, but are anticipated to be temporary as the site transitions to native vegetation.

Comment 8: Once the cattails have been removed, will WDFW be replanting the control areas and, if so, with what species? If the control areas are not going to be replanted, how frequently does WDFW contemplate having to repeat the cattail eradication?

Response: WDFW will not replant the area, but instead rely on existing seedbank and on native plants left in the treatment sites and from the surrounding areas to colonize the site, passively. WDFW will have to revisit the treatment areas annually to treat any invasive cattail regrowth using IPM and to avoid any native vegetation over the course of four years. The continual culling of invasive cattail will allow more native vegetation to grow and seed the area.

Comment 9: What best management practices (BMPs) will WDFW use to ensure that water quality is protected?

Response: Protecting water quality is important and will be accomplished in the following ways:

1. Herbicide applications must follow label and NPDES permit requirements which include measures to reduce contaminants entering the aquatic environment (e.g. effective rates, dry times, maximum wind speeds).
2. Only herbicides (glyphosate, imazapyr) and adjuvants (surfactant, marker dye) that are aquatically approved will be used.
3. Mechanical control of invasive cattail will reduce the amount of herbicide required.
4. To the extent practicable, airboats will be used to apply herbicide because they have no impact on substrates, nor do they cause turbidity.
5. Use of the Marshmaster to crush invasive cattail will occur during low tides eliminating turbidity issues.
6. Crushed cattail will be left in place, creating a layer that will reduce the potential of suspended sediment.
7. A ten foot standing cattail buffer will be left around crushed sites to contain crushed cattail and reduce wave energy and sedimentation.
8. Impacts to existing tidal marsh channels will be minimized through implementing the best management practices outlined in Comment #4, above.
9. Equipment will be properly maintained and checked daily for leaks. Equipment will not be permitted in the field until leaks have been repaired.
10. Food grade hydraulic fluids will be used in the Marshmaster.

Again, thank you for your time commenting on the project. Please let me know if you have further questions as the project develops.
Dave

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