Integrated Vegetation and Animal Management Guidance

Clean Water Services

March 2003
1.0 INTRODUCTION

Clean Water Services (District) recognizes the importance of preserving and enhancing water quality Sensitive Areas, Vegetated Corridors, and Storm Water Facilities. The District’s role in the watershed is to improve water quality and preserve aquatic species, in a manner that meets the intent of both the Clean Water and Endangered Species Acts. The District has developed the following guidelines for non-native, invasive vegetation management and animal management; these guidelines should be used in conjunction with a thorough native revegetation program (see CWS Design and Construction Standards Appendix E).

2.0 NON-NATIVE, INVASIVE VEGETATION MANAGEMENT

Non-native, invasive plants threaten the ecological processes that preserve the water quality functions of wetland and riparian areas. The revegetation strategies outlined in CWS Design and Construction Standards Appendix E help to promote biological diversity, plant competition, and succession, and are the first strategies to employ when reestablishing native vegetation. However, in the urban landscape, short term (3-5 years) maintenance is typically required before the conditions are adequate for revegetation to be successful. The non-native, invasive management strategies outlined in this document address short term maintenance options via cultural, mechanical, and/or chemical controls.

The District prefers non-native, invasive vegetation management activities that avoid impacts to water quality and aquatic resources. Consequently, the District gives primary consideration to “cultural” methods of vegetation control such as shading, solarization (the use of tarps and sun to heat the soil and force germination), or shifts in maintenance practices. Manual or mechanical means of vegetation management including the use of mowers, chain saws, cutters, etc. are next in line of preference, and will be utilized where-ever feasible. A systematic manual approach to invasive species removal such as the Bradley Method (i.e., first eliminating pest species from areas with the most desirable vegetation and then shifting efforts towards areas with the most serious infestation) shall be employed. Chemical herbicides and insecticides (referred to from this point forward as “Pesticides”) will be used only after the other methods have been employed and proven to be inadequate based on the site conditions. Although complete eradication of some non-native, invasive species is an unreasonable expectation due to disturbance conditions, the thoughtful application of an integrated program should provide a good measure of control, sufficient to support ecological succession.

Non-native, Invasive Plants

Non-native, invasive plants may be removed from Sensitive Areas, Vegetated Corridors, and Storm Water Facilities without environmental review, so long as the management strategies employed are an integrated approach based on the species and site conditions. Other non native plants not included in this section may also be removed, but are not of primary concern to the District at this time.
The characteristics considered during development of the following list include:

- Invasiveness potential
- Potential to displace native plants and to form a monoculture
- State or Federal listing
- Impact to aquatic and riparian resources

### Table 4.1 Effective Methods of Control for Non-native/Invasive Plants of Concern

<table>
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<th>Scientific Name</th>
<th>Common Name</th>
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<th>Man./Mech.</th>
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<td><em>Cirsium arvense</em></td>
<td>Canada thistle</td>
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<td><em>Clematis vitalba</em></td>
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<td><em>Cytisus scoparius</em></td>
<td>Scots broom</td>
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<td><em>Dipsacus sylvestris</em></td>
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<td><em>Hedera helix</em></td>
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<td><em>Heracleum mantegazzianum</em></td>
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<td><em>Lythrum salicaria</em></td>
<td>Purple loosestrife</td>
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<td><em>Phalaris arundinacea</em></td>
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<td><em>Polygonum cuspidatum</em></td>
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<td><em>Rubus discolor</em></td>
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<td><em>Solanum dulcamara</em></td>
<td>Bittersweet nightshade</td>
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<td><em>Vinca major/minor</em></td>
<td>Large/small leaf periwinkle</td>
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**Cultural Management Strategies**

Cultural management are strategies that incorporate natural processes (fire, flood) or low tech practices (solarization, mulching) to achieve the desired results. Flooding is limited to those areas where we have water management capabilities such as at Jackson Bottom for Fernhill Wetlands. Fire should be limited to spaces where it was historically used to manage the landscape (upland prairie / oak savanna) and can be safely controlled by local fire departments. Solarization, (the use of clear tarps and sun to force germination) is most appropriate for small areas of infestation or can be used in areas where the seed bank is rich in pest plant seed. Solarization is used to promote seed germination so that a chemical application can be applied for a final removal of the pest plant sources.

**Manual / Mechanical Management Strategies**

Manual/mechanical management are strategies that involve active removal of invasive species via hand or with equipment (weed whips, mowers, tillers). A systematic method of removal is most effective. The Bradley method consists of weeding small areas of infestation in a specific sequence, starting with the best stands of desirable vegetation and working towards those stands with the worst pest plant infestation. Initially, outlier pest

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1 See special considerations for pesticide use under Chemical (Pesticide) Management Strategies
plants that occur singly or in small groups at the edge of large patches for infestation should be eliminated. Next work on areas containing pest plants growing intermixed with desirable vegetation. Finally, work should focus on clearing the most dense pest plant patches.

**Pesticide (ie. chemical herbicides and insecticides) Management Strategies**

Pesticide use carries a greater risk of impacting water quality if misused, particularly in Sensitive Areas, Vegetated Corridors and Storm Water Facilities. The pesticides approved by the District for use in such areas, shall be used according to the manufacturer’s instructions and in full accordance with all applicable local, state, and federal laws. All appropriate safety measures shall be taken by any individual applying any chemical product. This document is not intended to contradict any local, state, or federal laws or any manufacturer’s instructions regarding the use and safety of pesticides. This document does, however, limit the types of pesticides the District will use in regulated Sensitive Areas, Vegetated Corridors and Storm Water Facilities – similar to the limits on the types of plant materials allowed. Any discussion of or recommendation for the application of any pesticide is not intended to be an endorsement of a specific brand of any such product.

**Criteria for Pesticide Use**

Pesticides may be used in Sensitive Areas, Vegetated Corridors, and Storm Water Facilities when the following criteria are met:

1) The pesticide is on the District list (see below) for use in Sensitive Areas, Vegetated Corridors and Storm Water Facilities; and
2) Other non-chemical strategies were attempted prior to chemical use; and
3) The activity is part of a short term (<3 year) eradication strategy, not a long term maintenance solution; and
4) The application follows the guidance provided in this document for the specific non-native invasive species in which the pesticide is being applied; and
5) If areas are on public lands or are publicly accessible, the treated areas are posted with "CAUTION" signs featuring information about the pesticides being applied and a phone number for additional information.
6) If areas are on public lands / rights of way or are publicly accessible, persons applying the pesticides shall be Oregon Department of Agriculture licensed applicators. Application of pesticides to aquatic sites will only be done by licensed personnel who have received an additional aquatics license certification.

**Pesticide Application**

Pesticide application should be carried out by hand with directed, low volume, single wand sprayers, wiping, daubing and painting equipment, or injections systems. Managing pesticide drift is of particular importance when surface waters are nearby. Nozzle size, pressure regulation, droplet size, and height of spray wand are all techniques that can be modified to reduce unwanted drift of pesticides. The use of a course spray and/or wipes minimizes the formation of fine mists that might be carried off target. Equipment used in the application shall employ all necessary methods to limit drift and ensure that the
pesticide reaches targeted plants or targeted soil surfaces. The broadcast spraying of pesticides is inconsistent with a limited, targeted approach and should be avoided.

Pesticides should never be applied when the any of following conditions are present:

- air temperature is over 80 degree Farenheit
- it is raining
- it is expected to rain within the next 72 hours
- wind speed is above five miles per hour
- wind direction or activity would carry pesticides toward or onto upon open water

Pesticides
Only the chemicals listed below may be used within in Sensitive Areas, Vegetated Corridors, and Storm Water Facilities. Pesticide choices must take into account any possible effects on aquatic resources as well as tendencies to move in the environment. A dye should always be used in the chemical mix in order to identify treated plants.

Additional information about pesticide use may be obtained from the Oregon Department of Agriculture Pesticides Division.

Post-emergent application:
- Glyphosate products (e.g., Rodeo)
- Triclopyr products (e.g., Garlon 3A and other amine formulations, not Garlon 4 or other ester forms)

Pre-emergent application:
- Napropamide (e.g., Devrinol WP, R- 7465)

Surfactant:
- LI 700 with standard dilution of 0.5% of spray solution or 0.25% for Glyphosate, only

Aquatic labeled (for use in certain circumstances in aquatic sites):
- Glyphosate (e.g., Rodeo, Aquamaster)
- Copper (e.g., Cutrine Plus)
- Aquashade (acid blue 9, acid yellow 23)

Surfactant:
- R-11 or equivalent

Larvicides for Mosquito Control: (See West Nile Virus Response Plan)
- *Bacillus thuringiensis* var. *israelensis* *Bti* serotype H-1 4 is a biologically derived insecticide for mosquito control. It is an endospore-forming bacterium which must be ingested by the larvae. *Bti* is most effective on young larvae. Its effectiveness is reduced in highly turbid (highly organic) waters.
- Methoprene insecticide (e.g., Altosid). An insect growth regulator (IGR), which acts by inducing morphological changes interfering with normal development.

Site-Specific Pesticide Use
For Sensitive Areas, the following application considerations apply:
- **Streams:** In the rare need for control of non-native, invasive plants within streams, mechanical and biological means will be utilized where possible. When these methods are not feasible, plants may be controlled using spot application of Glyphosate (e.g., Rodeo) and an approved surfactant, if needed, once the area of infestation has been isolated from flowing water. Chemical application shall be limited to mid-summer and shall not exceed a frequency of once a year, unless more aggressive control is needed for specific plants (such as for Japanese knotweed). Applicable permits from appropriate outside agencies will be obtained before this kind of treatment takes place. Submerged weeds shall not be controlled by chemical means in streams, rivers, or other moving waters.

- **Ponds and Lakes:** Pesticides will be used only for the control of non-native, invasive plants that threaten the health of the habitat. When chemical methods are necessary, plants may be controlled using spot application of Glyphosate (e.g., Rodeo) and an approved surfactant above the water line. The use of an appropriate aquatic labeled herbicide (e.g., Rodeo, Aquamaster), is allowed only where there is no direct outflow of the treated water to fish bearing streams or waterways and proper permits from outside agencies have been obtained. See West Nile Virus Response Plan for mosquito larvicide applications.

- **Wetlands:** Pesticides will be used only for the control of non-native, invasive plants that threaten the health of the habitat. When chemical methods are necessary, plants may be controlled using spot application of Glyphosate (e.g., Rodeo) and an approved surfactant above the water line. Chemical application shall be limited to mid-summer and shall not exceed a frequency of once a year, unless more aggressive control is needed for specific plants (such as for Japanese knotweed). See West Nile Virus Response Plan for mosquito larvicide applications.

For Vegetated Corridors the following application considerations apply:
- **Pesticide use within Vegetated Corridors** will be limited to the control of non-native, invasive plants that threaten the health of the habitat. Spot application of either Glyphosate or Triclopyr (amine formulations, only) along with an approved surfactant may be used during site preparation and revegetation maintenance.
For Storm Water Facilities the following application considerations apply:

- Pre-emergent herbicide use will be allowed only above the high water line during site preparation and revegetation. For post emergent applications, plants may be controlled using spot application of Glyphosate (e.g., Rodeo) and an approved surfactant above the water line. See West Nile Virus Response Plan for mosquito larvicide applications.

For Pre-existing Recreational Streamside Uses (e.g., Golf Courses, manicured Parks, etc), the following additional application considerations apply:

- Where Vegetated Corridors are not provided and regular lawn maintenance must occur, a minimum 25-foot no chemical pesticide or fertilizer application buffer to the streams and wetlands is recommended. If pesticides or fertilizer must be applied, they should be limited to a single application per year, during the months when runoff risk is minimized.
Cirsium arvense (Canada thistle)

Background
Cirsium arvense is a rhizomatous, herbaceous perennial found on mesic soils in disturbed areas such as roadsides, and overgrazed or abandoned pastures throughout the Portland metro area.

Key Features
- Colony forming perennial with one to four-foot tall stems
- New plants sprout from deep extensive horizontal root system
- Oblong or lance shaped leaves are divided into spiny tipped lobes
- Purple flowers up to ¾-inch bloom in mid summer.

Management Options

Cultural Control: Shading thistle infested areas with plantings of appropriate native trees and shrubs may prevent both seedling establishment and the spread of existing patches (Hodgson 1968). Soil solarization may also be used to control small patches.
Manual/Mechanical Control: A single mowing of thistle timed to coincide with the period between the early flower bud stage and the first sign of purple bloom weakens the plant at a time when root carbohydrate reserves are at a yearly low (Hodgson 1968). Sites should be monitored during late spring to determine the proper timing for mowing.

Biological Control: According to the Oregon Department of Agriculture, a European insect, the crown weevil (*Ceutorhynchus litura*) is establishing well in six counties in Oregon. It has been shown to weaken the plants by mining the stem pith. Other useful thistle biocontrol agents established in Oregon include the stem gall fly (*Urophora cardui*) and the seed head weevil (*Rhinocyllus conicus*).

In addition, a plant rust species (*Puccinia punctiformis*) is a possible thistle biological control agent in Oregon; especially for thistles growing in wet areas. Although the damage inflicted does not seem to be sufficient to control thistle on its own, there appears to be a synergistic relationship between the rust (*Puccinia punctiformis*) and the weevil (*Ceutorhynchus litura*).

Chemical Control: Chemical control of Canada thistle is difficult due to the plant's deep, well developed root system into which most broad-leaf perennial pesticides do not translocate. However, the 2002 Pacific Northwest Weed Control Handbook recommends nonselective control using either a 10 to 33 percent Glyphosate solution for wiper application or a two percent solution for handheld equipment. The chemical should be applied to leaves and stems when thistles are past the bud growth stage but before the flowering stage. Fall applications must be made before the first killing frost. Glyphosate will also kill grasses in the treated areas. A dye should be used in the chemical mix in order to identify treated plants.

Recommended Actions

Canada thistle populations should be controlled via timely mowing in the early summer when the plants are between the flower bud and bloom stage. Care should be taken to avoid scraping or scarifying the ground, as bare ground is an ideal substrate for thistle seed. In areas where thistle is intermixed with successful herbaceous and woody plantings, soil solarization or early summer flaming with a propane torch followed by fall reseeding with native grasses should be attempted. Spot treatment with wiper applied Glyphosate should be carried out prior to flowering.

Encouraging the rapid succession of all upland areas to a combination of riparian woodlands and upland grasslands may minimize the kinds of open canopy disturbed habitats that Canada thistle prefers.

Monitoring

All thistle control efforts should be thoroughly documented and then monitored for at least three years thereafter.
**Clematis vitalba** (Traveler’s joy)

**Background**  
*Clematis vitalba* is a woody, semi-shade tolerant perennial vine widespread on mesic soils in the Willamette Valley. It is a particularly common in disturbed, open canopy riparian and deciduous woodlands in the Portland metro area.

**Key Features**
- Woody vine with stems up to 50 feet tall
- Pointed compound leaves have toothed leaflets often in groups of three
- Tendrils form at stem nodes
- White or cream colored flowers with numerous one-inch long sepals

**Management Options**

**Cultural Control:** The general absence of *Clematis* seedlings in closed canopy woodlands (particularly coniferous) suggests that small seedlings may be dependent on light for survival. Protecting closed canopy woodlands from clearing, particularly of dense shrub or groundlayers, may prevent the establishment of seedlings.
**Manual/Mechanical Control:** The Bradley Method, which involves first removing outlier plants at the edge of large patches of infestation and then gradually working toward the areas of greatest infestation, has been shown to be effective. Vines between ground level and chest height should be removed from trees with loppers, making subsequent resprouts easier to see and cut. Cut material should be removed or piled and burned or chipped for mulch in order to prevent vegetative reproduction of cuttings. Clear zones around tree trunks should be established by pulling small seedlings when the soil is damp during winter or spring. After several trees/shrubs in a grouping are cleared, the remaining vines between the cleared trees should be removed. In this way, small cleared areas can be gradually linked, to form larger ones. Repeated removal of seedlings will gradually reduce the seedbank. However, suckers will resprout from roots until they are removed.

**Biological Control:** None known. Bio-control will probably not be approved due to the widespread availability of *Clematis* cultivars in the commercial nursery trade.

**Chemical Control:** Treatment with herbicides following mechanical removal of the vines should be conducted cautiously, as some chemicals promote vegetative regrowth from lateral roots and others may translocate, killing the vine’s support trees. A cut stem treatment of either undiluted Glyphosate or mix a 50 percent dilute solution of Triclopyr (amine formulations, only) with water should be applied when vines are actively growing except early spring. A dye should be used in the chemical mix to help identify treated plants.

**Recommended Actions**
The combination of mechanical removal and herbicide treatment offers the best possibility for control. Given the vigor of *Clematis* and its tremendous seed production, total eradication is probably not possible.

**Monitoring**
All *Clematis* control efforts should be thoroughly documented and then monitored twice yearly for at least three years thereafter.
Cytisus scoparius (Scots broom)

**Background**

*Cytisus scoparius* is a woody perennial found on disturbed xeric to mesic soils throughout the Pacific Northwest. Thanks to its tolerance of a variety of soil conditions and its ability to fix nitrogen and grow most of the year, it quickly invades overgrazed pastures, cultivated fields, grasslands, roadsides, and the dikes and berms along streams.

**Key Features**

- Shrub up to 10 feet tall
- Green stems with leaves in groups of three
- Bright yellow, pea shaped (bilateral) flower in May and June
- Gray, pea pod like seed capsules contain shiny black seeds
Management Options

Cultural Control: Although Scots broom is able to fix nitrogen year round, its ability to do so is limited by the inability of its *Rhizobium* bacterium to tolerate the acidity of many Western Oregon soils. Phosphorus and sulphur availability also strongly influences growth.

Manual/Mechanical Control: Scots broom is an early successional plant, which can be outcompeted if a healthy groundlayer plant community is maintained and if soil disturbance is kept to a minimum. Manual methods of control range from cutting and the use of the "Weed Wrench" for the removal of large plants to hand pulling or mowing for the control of small seedlings. The Bradley Method (focussing initial removal efforts in areas with the best stands of desirable vegetation and then shifting towards areas with the worst infestation) is recommended. Plants with stem diameters greater than one inch should be cut in late summer during time of maximum drought stress.

Biological Control: The seed feeding weevil *Apion fuscrostre*, introduced in 1983, has become established throughout western Oregon and may hold promise for sites with particularly large Scots broom populations. The Oregon Department of Agriculture publication, *Broom/Gorse Quarterly*, is a good source of information.

The initial results of recent experiments by Metro at three of its sites in the Portland area suggest that goats provide good preliminary Scots broom removal.

Chemical Control: A 1.5 to 2.0 percent Glyphosate solution or a 1.0 to 1.5 percent solution of Garlon 3A should be applied to freshly cut stems anytime the plant is actively growing except during early spring. A dye should be used in the chemical mix to identify treated plants.

Recommended Actions
Scots broom plants are relatively easy to eradicate using a combination of manual and chemical treatments. Adult plants should be “Weed Wrenched” when they are in bloom during the months of May and June. Followup control using a combination of cutting and herbicide techniques should be done in August at a time of maximum drought stress. Plants should be cut as close to the ground as possible and the stumps painted with herbicide.

Monitoring
A yearly surveying and monitoring program is necessary given Scots broom's invasive tendencies.
**Dipsacus sylvestris** (Common teasel)

**Background**

*Dipsacus sylvestris* is a widespread, biennial or short lived perennial that grows on mesic to hydric soils on the edges of agricultural fields and roadsides, as well as along dikes, berms, and wetland margins. The ability of the seeds to be dispersed via water facilitates downstream colonization.

**Key Features**

- Taprooted perennial up to six feet tall
- Striated stem with rows of downward pointed prickles
- Leaves strongly veined with stiff prickles on midrib
- Dense headed purple flower in June and July

**Management Options**

**Cultural Control:** Teasel germination may be hindered by heavy litter cover such as that found on prairies that have not been burned or mowed. Soil
solarization should be attempted in areas where nonselective control is appropriate.

**Manual/Mechanical Control:** Carefully timed mowing and cutting has proven to be an effective control method. Flowering stalks should be cut at ground level once flowering has begun. If plants are cut at this time most plants should not reflower and will die at the end of the season. All cut flower stalks should be removed from the field, as seeds can become viable on the stem even after cutting. The plants should not be mowed after seed heads have formed. Suitable cutting tools include: loppers, weed whacker hand tools or gas powered string line trimmer (fitted with blade for old stands). As teasel seed is viable for up to two years, mowing/cutting may need to be repeated for several years.

**Biological Control:** None available.

**Chemical Control:** Nonselective control using two percent Glyphosate solution applied with handheld equipment provides good control. The mixture should be applied to rosettes or leaves and stems in either early spring before grasses and other desirable herbaceous vegetation break dormancy or in the fall after the surrounding herbaceous vegetation is dormant. Fall applications must be made before the first killing frost. Glyphosate will also kill gasses in the treated areas. A dye should be used in the chemical mix in order to identify treated plants.

**Recommended Actions**
With persistence and proper timing, teasel may eventually be controlled using mowing/cutting techniques. If the timing of cutting is off, herbicide application may be required. Application of Glyphosate in early spring or fall is the preferred method. Soil solarization should be tried on small infestations. Minimizing bare ground and any soil disturbance outside the limits of construction will reduce preferred teasel habitat. Revegetation efforts should encourage the rapid succession of all upland areas to a combination of closed canopy riparian woodlands and upland grasslands.

**Monitoring**
All teasel control efforts should be thoroughly documented and then monitored for at least three years thereafter.
**Hedera helix & Hedera ssp. (English Ivy)**

**Background**
*Hedera helix* and its cultivars are woody, evergreen vines found throughout western Oregon, particularly in disturbed woodlands such as Forest Park in Portland. Ivy roots grow deep and fill soil densely; the heavy vines will smother both evergreen and deciduous trees and shrubs, distorting their growth or contributing to their windthrow.

**Key Features**
- Evergreen groundcover
- Aerial roots at stem nodes
- Waxy, three-lobed leaves positioned alternately on stem

**Management Options**

**Cultural Control:** Flaming ivy leaves with a kerosene or propane torch after the vertically growing vines have been cut and removed from trees can be effective. Treated areas should be checked the day after treatment and re-flamed as needed. Retreatment is usually necessary up to three to four times per season. The advantage of flaming control is that the ground is not disturbed nor is the native groundlayer vegetation harmed. For safety reasons, this method should not be
attempted if there is a leaf litter layer, as it can start a fire. Teams of people should be available with water backpacks to check treated areas for smoldering.

**Manual/Mechanical Control:** The Bradley Method, which involves first removing outlier plants at the edge of large patches of infestation and then gradually working toward the areas of greatest infestation, has been shown to be effective. Vines between ground level and chest height should be removed from trees with loppers or pruning shears, making subsequent resprouts easier to see and cut. Cut material should be removed or piled and burned or chipped for mulch in order to prevent vegetative reproduction of cuttings. Clear zones around tree trunks should be established by pulling small seedlings when the soil is damp during winter or spring. After several trees/shrubs in a grouping are cleared, the remaining vines in between should be removed. In this way, small cleared areas on the edges of larger infestations can gradually be linked, forming larger ivy free areas.

**Biological Control:** Bio-control is probably not an option in the future given the widespread use of ivy as an ornamental landscape plant. However, the initial results of experiments by Metro staff at three sites in the Portland area in September 2002 suggest that goats provide effective ivy removal prior to other control efforts.

**Chemical Control:** The waxy leaves of *Hedera* limit uptake of herbicides. Glyphosate applied with the appropriate surfactant may be most effective when the leaves are first cut with a string line trimmer and then allowed to form new leaves. The surfactant degrades in a short time, so only small patches that can be applied in less than one hour should be mixed. A dye should be used in the chemical mix in order to identify treated plants.

**Recommended Actions**
Manual/mechanical efforts such as the No Ivy League's work in City of Portland natural areas appear to be the best means of control. Control efforts should focus on small, well defined areas and should be coupled with active replanting and monitoring efforts. Hand pulling and string line trimming, followed by limited herbicide use has proven effective. Flaming should also be attempted when the situation permits. Public education is a vital component of any control effort; there is strong evidence that most infestations originate near homeowner landscapes where ivy has been planted. The dumping of yard debris in natural areas is also a big problem, as ivy cuttings root readily.

**Monitoring**
Given the widespread extent of the problem in the Portland metro area, the control of ivy is probably a permanent undertaking in the foreseeable future. Monitoring of infestations and treated areas should be done at least twice yearly.
**Heracleum mantegazzianum (Giant Hogweed)**

**Background**

*Heracleum mantegazzianum* is originally from Asia and was introduced as an ornamental. The plant produces a clear, watery sap containing toxins that cause photo-dermatitis. Skin contact followed by exposure to sunlight produces painful, burning blisters that may develop into purplish or blackened scars. Giant hogweed may colonize a wide variety of habitats but is most common along roadsides, other rights-of-way, vacant lots, streams and rivers. Except for size, it closely resembles cow parsnip, *Heracleum lanatum*, a plant native to our area.

**Key Features**

- Parsley or carrot-like plant 15 to 20 feet tall
- Stout, dark reddish-purple stem and spotted leaf stalks
- Compound leaves to five feet in breadth
- Broad, flat-topped, white inflorescence up to 2-1/2 feet in diameter

**Management Options**

**Cultural Control**

Mature plants can be removed manually if at least the first four to six inches of the central root is removed. Younger plants are more resilient and are often present in greater numbers in a dense, mature infestation. Both of these factors make manual removal of young plants less practical. Seedlings can number in the hundreds and may break off when being pulled from more compacted soils, leaving the root to continue growing.
Manual/Mechanical Control
Mowing will only be effective for short periods of time and will have to be repeated every two weeks. Since some plants will send up increasingly sturdy resprouts after being cut back repeatedly, it may be best to dig those out. Eventually, the seedbank in the soil will be exhausted without the introduction of new seeds by flowering plants, but this may take several years.

Biological Control
Cattle and pigs are cited as possible biocontrol agents. Both eat giant hogweed without apparent harm. Trampling also damages the plant.

Chemical Control
Herbicides should only be applied at rates recommended and for the site conditions and land usage specified on the label. Apply to the entire leaf and stem surface of actively growing plants and do not cut the stem after applying the herbicide since this will stop the plant from absorbing the herbicide into the roots. An area of heavy seedling infestation can be efficiently controlled by an herbicide application in spring, possibly followed by an application later in the summer for late sprouts. Glyphosate is effective, but is a non-selective herbicide and will also kill grasses in the area being sprayed. Established, larger leafed plants are more likely to prevent the glyphosate from contacting the understory grasses or other plants nearby. Treatment with glyphosate may need to be followed by re-seeding with grass or other vegetation appropriate to the site. Bare areas can be re-infested with hogweed or other weeds. Spraying hogweed seedlings with glyphosate will more likely result in damage to grasses and other desirable plants. Triclopyr (amine formulations, only) works quickly and effectively, producing noticeable damage to the plant within 3-7 days. Triclopyr is a selective herbicide that only acts on broadleaf plants. A dye should be used in the chemical mix in order to identify treated plants.

Recommended Actions
Single, mature plants should be dug up if care is taken to remove at least 4 to 6 inches of root. Smaller plants should be pulled, although root fragments are likely to re-sprout. Large, established infestations require several different control techniques to eliminate the larger mature plants as well as the seedlings. Control large plants either with herbicide or by digging them up. Control seedlings and young plants by applying the herbicide appropriate for the site or by carefully digging up all of the plants. Monitor the area for at least three years and repeat the control treatment as needed. Flowers and seed heads should be placed in a plastic garbage bag and removed from the site.

Monitoring
All giant hogweed control efforts should be thoroughly documented and then monitored twice yearly for at least three years thereafter.
Lythrum salicaria (Purple loosestrife)

**Background**

*Lythrum salicaria* is an introduced, semi shade tolerant woody perennial that grows along the edges of ponds and riparian corridors, and in wetlands throughout Oregon. Its prolific, highly viable seed is easily transported by the wind and can completely colonize emergent wetlands and moist riparian woodlands within several growing seasons.

**Key Features**

- Shrubby perennial up to eight feet tall
- Lance shaped, whorled leaves positioned oppositely on stem
- Long vertical raceme of rose/purple flowers in mid-late summer

**Management Options**

**Cultural Control:** None known

**Manual/Mechanical Control:** First year plants are easy to pull. All plant material should be removed after pulling. Established plants can be difficult to pull due to extensive root mats. Plants will resprout unless entire root is removed.
Mowing is effective if cuttings dry rapidly. The removal of budding stalks during the flowering season is also effective.

**Biological Control:** As of 1997, three insect species from Europe have been approved by the U.S. Department of Agriculture for use as biological control agents. These plant-eating insects include a root-mining weevil (*Hylobius transversovittatus*) and two leaf-feeding beetles (*Galerucella calmaris* and *Galerucella pusilla*). Two flower-feeding beetles (*Nanophyes*) that feed on various parts of purple loosestrife plants are still under investigation. *Galerucella* and *Hylobius* have been released experimentally throughout the northern U.S.. Most of the biological control efforts in Oregon are being conducted with the assistance of Oregon State University and the U.S. Fish and Wildlife Service.

**Chemical Control:** Triclopyr as Garlon 3A is labeled for use on non-irrigation ditch banks and can be used on seasonally dry wetlands. It does not kill seeds and, therefore, must be applied repeatedly. Glyphosate with a wetting agent is the chemical of choice for controlling loosestrife not growing directly in water. Like Triclopyr, it does not kill seeds. A dye should be used in the chemical mix in order to identify treated plants.

**Recommended Actions**
Small infestations of young Purple loosestrife plants should be pulled by hand, preferably before seed set. Spot treating of older plants with pesticides is effective if application takes place late in the season when plants are preparing for dormancy. However, it may be best to do a mid-summer and a late season treatment, to reduce the amount of seed produced.

While herbicides and hand removal may be useful for controlling individual plants or small populations, biological control may have the greatest potential for the long term control of large infestations.

**Monitoring**
Purple loosestrife infestations should be monitored annually during the flowering season, generally from mid summer until mid October.
Phalaris arundinacea (Reed canarygrass)

Background
Phalaris arundinacea, a perennial grass, reproduces from rhizomes and seed and is found on disturbed sites such as urban stream floodplains, irrigation canals, and old pastures throughout the Pacific Northwest. It also actively invades natural wetlands, especially wet prairies and emergent marshes. Streams serve as dispersal corridors for seeds.

Key Features
- Stout, perennial grass with stems two to seven feet tall
- Stems sprout from nodes on large, running rootstock
- Bluegreen leaf blades ¼” to ¾” wide
- Flower (panicle) compact at first, then the branches spread by mid summer

Management Options

Cultural Control: Prolonged annual flooding using water control structures has been used with some success. Soil solarization with plastic sheeting may be used to control small, well defined infestations. Shading has also been proposed as a method of control (see below).

Manual/Mechanical Control: Earth movers and bucket loaders have been used to scrape rhizome mats and seeds from large patches. The outcome has been mixed, however, as such activities alter local hydrological conditions and, in the best cases, Phalaris has returned to fringe areas.

Monthly shallow tillage during the growing season for two full years has prove
necessary to kill *Phalaris* rhizomes and seeds. Once control is achieved, the area should be densely seeded with native wetland emergents and/or grasses.

**Biological Control:** None available

**Chemical Control:** Glyphosate is effective for nonselective control. The chemical should be applied to actively growing plants at early heading or in the fall from mid-September to just after the first light frost. A second herbicide application may be made after 21 days. Standing grass should then be flail mowed and the area replanted with native emergents and grasses. A dye should be used in the chemical mix in order to identify treated plants.

**Recommended Actions**
The following recommendations were adapted from Clayton J. Antieau of the Washington State Department of Transportation.

Wetland and riparian areas should be planted with appropriate tree species, emphasizing conifers, which are highly effective in eliminating stands of Reed canarygrass. The conifers need to be planted relatively densely in wide blocks in both wetlands and adjoining riparian areas. Faster growing, more competitive plants such as willow, red alder (*Alnus rubra*), and/or cottonwood (*Populus trichocarpa*) may also be used. These can be selectively thinned several years later and underplanted with appropriate conifer species.

Avoid excavation as a means of eradicating existing stands of Reed canarygrass. Excavation should be driven by project goals for altering hydrologic regimes, rather than as a direct weed management tool.

The use of flaming, which creates fewer air quality and safety hazards than burning, can be highly effective. Repeated treatments with hand-held or implement-based flaming devices over a year or more may be needed to eradicate established stands. Dead culms and leaves from previous year’s growth should be removed prior to starting a flaming regime to minimize the fire and smoke hazards and to create better flame access to emerging shoots.

Glyphosate can be an effective tool in managing Reed canarygrass, particularly when integrated with other methods. Reactions against the use of Glyphosate should be balanced by the consideration that the effects of herbicide applications in aquatic systems may be greatly exceeded in the long term by dramatic improvement in riparian and wetland habitats.

**Monitoring**
After Reed canarygrass control has been implemented, surveying and monitoring of the site should be conducted monthly during the following three growing seasons in the years thereafter.
Polygonum cuspidatum (Japanese knotweed)

Background
Polygonum cuspidatum is an herbaceous perennial that forms large bamboo-like stands. It can reproduce by seed or by large rhizomes and has become established in the Pacific Northwest in recent years along gravel bars, streambanks, and roadsides. The plants thrive in moist soils, and often become established via the unintentional transport of rhizome segments in soil or cuttings from cultivated gardens. Dispersal also occurs when rhizome fragments are washed downstream by the current and deposited on banks. Once established, it forms large, monospecific stands that are extremely persistent and difficult to eradicate and that displace virtually all other vegetation.

Key Features
- Stout bamboo-like stems four to eight feet tall
- Broadly ovate leaves four to six inches long
- Small greenish white flowers borne in open, drooping panicles

Management Options

Cultural Control: Shading, particularly in conjunction with cutting, may be a useful means of controlling smaller stands of Japanese knotweed. Studies suggest that covering stands with black plastic or shade cloth may also be effective.

Mechanical/Manual Control: Grubbing is effective for small initial populations or environmentally sensitive areas where herbicides cannot be used. A Pulaski or similar digging tool can be used to remove the entire plant including all roots and
runners. Juvenile plants can be hand pulled depending on soil conditions and root development. Any portions of the root system not removed will potentially resprout. All plant parts (including mature fruit) should be removed to prevent reestablishment. Small stands may be controlled by repeated cutting (three times or more), followed by revegetation with native species.

**Biological Control:** The genetic uniformity of *Polygonum cuspidatum* makes it a good candidate for biological control. Biological control may be necessary where it has taken over vast areas, but only very preliminary biological control work has been done and it may be years before a successful control agent can be found.

**Chemical Control:** Cut stem treatment can be effective in areas where plants are established within or around non-target plants. This treatment remains effective at low temperatures as long as the ground is not frozen. Stems should be cut about two inches above ground level and a 25 percent solution of Glyphosate (e.g., Rodeo) or Triclopyr (amine formulations, only) and water applied immediately. A subsequent foliar application may be required to control new seedlings and resprouts. The foliar spray method may be used to control large populations. A two percent solution of Glyphosate or Triclopyr (amine formulations, only) and water combined with a 0.5 percent non-ionic surfactant should be applied to foliage. Air temperatures should be above 65°F. A dye should be used in the chemical mix in order to identify treated plants.

**Recommended Actions**
To date, large stands of Japanese knotweed have been extremely difficult to eradicate without repeated application of herbicides. However, establishment can be prevented fairly easily by removing plants before they become firmly entrenched. In areas where it has not yet become established, the focus of management efforts should be to prevent establishment by monitoring areas, particularly those downstream from known stands. Manual control can be labor intensive, but may be the best option where populations are small and isolated.

**Monitoring**
After Japanese knotweed control has been implemented, surveying and monitoring of the site should be conducted monthly during the following three growing seasons. Japanese knotweed should be considered a zero tolerance species.
**Rubus discolor** (Himalaya blackberry)  
**Rubus laciniatus** (Evergreen blackberry)

**Background**  
*Rubus discolor* and *Rubus laciniatus* are widespread, woody perennials found on overgrazed pastures, hedgerows, woodland edges and the dikes and berms along seasonal waterways throughout the Pacific Northwest. Their success is due to their tolerance of many soil types and conditions, and to their ability to propagate readily from seed, tip runners, and underground rhizomes. The fruits of these species are very attractive to wildlife and birds.

**Key Features**
- Potentially large, sprawling groundcover up to 15 feet tall
- Top and bottom of leaf veins extremely thorny
- Mature leaf clusters in groups of five

**Management Options**

**Cultural Control:** Blackberry is somewhat intolerant of shading by overhead trees with a dense canopy, particularly evergreens. The susceptibility of seedlings to shading suggests that few seedlings will survive in dense grasslands or conifer forests; seedling establishment is more common in open habitats such as land neglected after cultivation or along eroded stream banks.

**Mechanical/Manual Control:** Repeated mechanical removal (two to three times per year) with tractor mounted flail mower, brush cutters, power saws or machetes, and burning may be the most effective method of removing mature
canes, but followup treatments are necessary as the root crown will simply resprout and produce more canes. If only a single mowing can be done, the best time is when the plants are in flower as the plant is at its weakest. If mowing is done before seed set the piles of debris may be left for enhancement of wildlife habitat or burned; debris can also be chipped and used for mulch for revegetation plantings. Care should be taken to prevent vegetative reproduction of cuttings, which root readily. Hand grubbing of seedlings with a claw mattox is effective in areas where desireable vegetation prevents mowing. It should be carried out after a rain when the soil is loose. Hoeing several times during the growing season will gradually weaken the plant, but removal of mature canes alone will not control Blackberry. If repeated tillage is used a a means of control, it should be repeated for two to three growing seasons.

**Biological Control:** The USDA will not support introductions of bio-control agents due to their potential threat to commercially important *Rubus* species. However, the initial results of experiments by Metro staff at three sites in the Portland area in September 2002 suggest that goats effectively removed Blackberry canes.

**Chemical Control:** A 1.0 to 1.5 percent Glyphosate solution should be applied with a brush or squeeze bottle to freshly cut stems in September-October after berries have formed. Fall treatments must be made before frost. Repeat treatments may be necessary. Treatment with herbicides should be conducted cautiously, as herbicides may be translocated to other plants and, in some cases, may promote vegetative regrowth from lateral roots. A dye should be used in the chemical mix in order to identify treated plants.

**Recommended Actions**
The combination of mechanical and chemical treatments may be necessary to control Blackberry. Top growth should be removed in the spring via flail mowing or blade trimming. Freshly cut stems should be painted with a Glyphosate solution during September-October before the first frost. On highly disturbed flat ground, shallow tillage with a disc for two to three growing seasons followed by the dense seeding of a nonpersistant cereal such as Regreen will likely control small patches of Blackberry. Cleared areas should be revegetated with native plants during the late fall-winter.

**Monitoring**
All Blackberry control efforts should be thoroughly documented and then monitored for at least three years thereafter.
**Solanum dulcamera** (Bittersweet nightshade)

**Background**
*Solanum dulcamera* is a vine-like, rhizomatous perennial with a persistant woody base. It prefers the moist habitat along the edges of disturbed wetlands, ditches, and riparian corridors, and forms dense thickets.

**Key Features**
- Trailing or climbing perennial with stems up to 10 feet long
- Dark green, heart shaped leaves often have one to several leaflets at base
- Star shaped purple flower with yellow center followed by bright red berry

**Management Options**

**Cultural Control:** In areas where nightshade is intermixed with successful herbaceous and woody plantings, flaming with a propane torch followed by fall reseeding with native grasses should be attempted. Soil solarization may also offer good control, as the shallowly rooted rhizomes are susceptible to heat treatment.

**Manual/Mechanical Control:** Cutting should be carried out before the plant flowers to minimize the distribution of seed. Repeated tillage during the growing
season followed by the fall seeding of a dense stand of sod forming grasses provides good control. Fair results may also be obtained by removing the above ground portion of the plants through repeated cutting. However, debris should be picked up and destroyed, as stems propagate easily from cuttings. Although helpful, the removal of the roots by hand is difficult even when the soil is damp due to the plants rhizomatous nature.

**Biological Control:** None known

**Chemical Control:** Herbicides should be used with caution, as they may translocate to the vine's support tree or shrub and, in some cases, may promote vegetative regrowth from lateral roots. When chemical treatment is deemed necessary, undiluted Glyphosate may be applied to freshly cut stems with a brush or squeeze bottle whenever plants are actively growing except early spring. A dye should be used in the chemical mix in order to identify treated plants.

**Recommended Actions**
The integration of hand pulling, mowing, tilling, flaming, soil solarization, and chemical treatment may be necessary to control nightshade. Following control efforts, the dense seeding of a moist ground tolerant, nonpersistant grass will provide competition to resprouting Nightshade.

**Monitoring**
Monitoring of infestations and treated areas should be done at least twice yearly.
**Vinca major** (Large leaf periwinkle)
**Vinca minor** (Small leaf periwinkle)

**Background**

The *Vinca* spp. are shade growing, evergreen groundcovers with stoloniferous roots. They will grow in the deepest shade, even in poor soil and can be extremely invasive if allowed to establish in sheltered areas or woodlands. Their roots fill soil densely; branches root as they grow further knitting soil into an impenetrable web. In mature infestations the mounds of leaves and root mass may cover the ground to a depth of six inches and herbaceous groundlayer species succession may be altered.

**Key Features**

- Groundcover up to one foot tall
- Shiny, oval leaves positioned oppositely on stem
- Light blue, five petaled flowers in late spring

**Management Options**

**Cultural Control:** None known.

**Manual/Mechanical Control:** Repeated mowing or string line trimming (three to four times) during the growing season may provide fair control. In the year following removal efforts, periwinkle resprouts should be pulled out by hand and native groundlayer plants installed.

**Biological Control:** None known or likely to be developed.
**Chemical Control:** Environmentally benign herbicides are not effective on *Vinca* due to the waxy cuticle of the leaves that make chemical penetration difficult. For nonselective control, the greatest success occurs when patches of *Vinca* are first cut and then immediately treated (within 5 to 10 minutes) with Glyphosate in a three percent solution. A dye should be used in the chemical mix in order to identify treated plants. Followup spot treatments may be necessary.

**Recommended Actions**
Mowing and cutting followed by the grubbing of surviving plants should be the primary control method, as there is little evidence that the plants spread by any means other than stolon rooting. Public education is a vital component of any control effort; there is much evidence that most natural area infestations occur adjacent to homeowner's landscapes where *Vinca* has been planted. The dumping of yard debris in natural areas is also a big problem, as *Vinca* cuttings root readily.

**Monitoring**
Monitoring of infestations and treated areas should be performed at least twice yearly.
3.0 WILDLIFE DAMAGE MANAGEMENT

The District recognizes that native wildlife such as beaver, deer, ducks, geese, mice, and voles are natural and desirable components of the environment. While these species may occasionally cause damage to vegetation, property, and water quality (when in over-abundance) they also contribute to habitat quality and diversity. The District accepts and tolerates native species activities and will foster this attitude and philosophy through education.

Damage Caused by Native Wildlife on Private Property (No District Drainage Easement)

If an emergency exists (e.g., flooding of a structure or street, or other significant property damage either occurring, or likely to occur), and with the approval of the property owner, District staff will proceed with an appropriate remedial activity as determined by the District. In making this determination, the prevention of significant property damage from flooding (primarily flood damage to a structure) will be the highest priority.

If neither flood damage to a structure nor other significant property damage is occurring, or is likely to occur, the District will advise the property owner on how to protect his or her property while accommodating wildlife.

Damage Caused by Native Wildlife on District Property or within a District Drainage Easement

If an emergency exists (e.g., flooding of a structure or street, or other significant property damage either occurring, or likely to occur), District staff will proceed with an appropriate remedial activity as determined by the District. In making this determination, the relief and prevention of significant property damage from flooding (primarily flood damage to a structure) will be the highest priority. If appropriate, the District will consult with the appropriate agency regarding removal of the problem animal(s).

If neither flood damage to a structure nor other significant property damage is occurring, or is likely to occur, the District will take reasonable and cost effective steps to minimize damage to vegetation or structures while accommodating wildlife activity. If appropriate, the District will hold a neighborhood meeting to discuss management options.

Management Strategies

The following fact sheets provide management strategies for the most common species that impact revegetation. If species are known to be present at the site, preventative protection strategies shall be employed, to reduce the need for further revegetation due to plant loss.
Odocoileus hemionus columbianus (Black-tailed deer)

Background
Deer may hinder reforestation efforts by damaging young trees and shrubs through herbivory and antler rubbing.

Management Options

Exclusion: In urban and suburban areas with large deer populations, individual seedlings may be protected with tubes of netting or corrugated plastic. These typically last for three to five years and can protect just the growing terminals or can completely enclose small trees. Tubes should be attached to a support stake. Bud caps are rectangular pieces of material folded lengthwise and stapled around the terminal leader, may be used to protect the terminal leader and bud.

Tubes placed around the trunks of larger trees will help prevent trunk damage. Tubes may not, however, provide total protection when bucks use the trees to scrape their antlers.

Deer fences should be at least 72” tall and secured to the ground to prevent deer from crawling underneath. The bottom 4’ of the fence should be made of woven wire. Rows of wire should be stretched across the top of the fence at six-inch intervals.

Repellents: The two types of commercially available deer repellents are contact and area repellents. Contact repellents are applied directly to plants, causing them to taste bad. Area repellents are placed in a problem area and repel by their foul odor. Repellents are generally more effective on less preferred plants. Repellents should be applied during dry weather with temperatures above freezing. Young trees should be treated completely, while older trees may be treated only on their new growth.

A spray of 20 percent whole eggs and 80 percent water is also effective. To prevent the sprayer from clogging, remove the white membrane attached to the yolk before mixing the eggs. The egg mixture is weather resistant but must be reapplied in about 30 days.

Recommended Actions
New plantings in areas where deer are active should be protected using a combination of corrugated plastic tubes and terminal bud protectors. Trees should be supported with sturdy stakes. While repellents can also provide good protection, monitoring and reapplication are required.

For more information, contact Clean Water Services at 503-846-8621 or askus@CleanWaterServices.org
Living with Native Wildlife: Damage Management Guidelines

*Branta spp.*, *Anas spp.* (Resident/non-migratory geese and ducks)

**Background**
Resident or non-migratory geese and ducks are attracted to golf courses, parks, lawns, streams, and wetlands where regular feeding by humans can result in unnaturally high population densities. This can hinder revegetation efforts, damage existing vegetation, and impair water quality.

**Management Options**

**Habitat Modification:** Well-manicured lawns and newly seeded areas provide excellent habitat for grazing geese and ducks. To discourage grazing, grasses surrounding water bodies should be allowed to attain its full height (10-14”). Where possible, these areas should be fenced temporarily and replanted with native trees and shrubs.

**Feeding Reduction:** Well-fed domestic or non-migratory waterfowl often act as decoys, attracting wild birds to a site. Once feeding is discontinued, geese will disperse and revert to higher quality natural foods. Geese that depend on human handouts are also less likely to migrate when severe winter weather arrives, and are more vulnerable to disease.

**Recommended Actions**
Supplemental feeding should be stopped as a first step in any control program. Wild geese and ducks are very capable of finding other foods and will survive without handouts from humans. Some success in reducing goose feeding may be achieved through public education, such as posting of signs.

For more information, contact Clean Water Services at 503-846-8621 or askus@CleanWaterServices.org
Living with Native Wildlife: Damage Management Guidelines

*Mictotus spp.* (Voles/field mice)

**Background**
Voles, also known as field mice, can interfere with reforestation efforts by severely damaging or girdling young trees and shrubs. Damage to woody plants usually occurs between late fall and early spring. During these months, green vegetation is scarce and voles feed on woody plants. Individual, irregular tooth marks (about one-sixteenth inch wide) may be visible on the wood after winter vole damage.

**Management Options**

**Habitat Reduction:** High vole populations cannot become established without food and protection from predators. Reducing the suitability of habitat for voles lessens the likelihood of future damage. Management of herbaceous vegetation around plantings can significantly reduce rodent damage at a restoration site.

**Exclusion:** Individual plants may be protected from rodents through the use of wire-mesh (one-fourth inch or smaller mesh), aluminum screen cylinders, or plastic tree shelters. The mesh should be about 12” high and the bottom should be tight to the ground or buried slightly. Where pine voles are a problem, the fence should extend about six inches below ground. Fences also help keep out other wildlife that cause damage, such as rabbits and ground squirrels.

**Recommended Actions**
The presence of voles does not always result in significant damage to desirable vegetation. However, because of their prolific and cyclic nature, high populations can build up quickly and become a cause for concern. As in most vertebrate pest situations, a combination of control methods may be more effective than any single method. Most vole damage problems in urban and backyard areas probably involve small vole populations that can be controlled with habitat modifications, fencing or exclusion. The extent of the problem should be evaluated in relation to the control costs before any such measures are undertaken.

Grasses surrounding new plantings should be mowed or selectively trimmed to a height of four to six inches several times during the growing season.


*Castor canadensis* (Beaver)

**Background**

Beaver activity can result in damage to trees and shrubs in wetland and riparian areas. Although beaver dams do manipulate the geomorphic character of the stream/wetland environment over time, with the exception of clogging by debris, they rarely influence flood elevations. However, excessive sedimentation behind a beaver dam may cause upstream flooding as the channel bed elevation increases with sediment deposition.

The District’s policy regarding beaver management supports the Oregon Plan for Salmon and Watershed guidelines adopted in May of 1999. As such, it reflects the following:

- The construction and maintenance of dams by beaver is a natural process benefiting salmon and other fish and wildlife species by creating beneficial pool and wetland habitat in many stream reaches.
- The goal of management efforts should be to maintain or improve the distribution and amount of beaver pond habitat without creating unacceptable risks of damage to other public and private resources.
- Lethal control is usually only a temporary solution. Beaver populations are at or near carrying capacity and removing a beaver only opens up living space for a new beaver.

**Management Options**

**Exclusion:** Individual trees may be enclosed with 12 to 16 gauge welded wire mesh that forms a cylinder standing at least six inches away from the trunk and at least four feet tall. In floodplain areas subject to high stream flows, two support posts may be required.

**Beaver Dam Removal/Modification:** In the event of significant flooding of a structure or other significant property damage, the District (or the owner of a private property) may remove or modify the beaver dam to restore flow, install perforated pipes to keep the water level down, increase capacity through culverts on the floodplain or otherwise lower the water level to prevent flooding.
**Beaver Removal:** District staff will not trap, remove, or kill beaver. Where appropriate, the District (or the owner of a private property) may request assistance from the Oregon Department of Fish and Wildlife (ODFW), which has
the authority to regulate the trapping, hunting, and transportation of beaver. Beaver may be taken during trapping season by a licensed trapper or by the landowner with a landowner trapping license. Lethal control outside the trapping season requires a kill permit issued by ODFW to the landowner.

**Recommended Actions**

Lethal and non-lethal beaver removal have proven largely ineffective as long term control techniques and are, therefore, discouraged by the District.

In the event of significant flooding of a structure or other significant property damage, the District will seek ways of accommodating beaver activity without endangering structures or degrading the water resource. Individual trees should be protected in the manner described above.
Non-Native Wildlife: Damage Management Guidelines

Myocastor coypus (Nutria)

Background

Nutria are non-native rodents that girdle trees and shrubs, thereby hindering reforestation efforts in Sensitive Areas, Vegetated Corridors, and Storm Water Facilities. Burrowing by Nutria causes significant damage in areas of infestation, and their large tunnels weaken stream and pond banks, exacerbating erosion problems in these areas.

In Oregon, nutria are classified as unprotected Nongame Wildlife (OAR 635-044-0132). As unprotected wildlife, nutria may be trapped or shot. No license is needed for a landowner to control nutria on his/her own property. Most cities have restrictions on leg-hold trapping or the discharge of firearms within their city limits. Live trapping is usually the main population control measure in urban and suburban areas.

Management Options.

Nutria Removal: Although the District will not trap, remove, or kill nutria, it may request assistance from a wildlife management agency or independent contractor to provide such services.

Exclusion: Wire mesh cylinders around individual trees or shrubs are often used where only a few plants need to be protected. Wire mesh fences approximately three feet high and with an apron buried to a depth of at least six inches have been used effectively to exclude nutria from home gardens and lawns. Electric wire barriers have also been used to exclude nutria where vegetation can be controlled to keep it from shorting the wires.

Recommended Actions

The District’s policy regarding nutria seeks to reduce grazing and burrowing activity by controlling population growth. Since nutria are usually found in waterways, there is often an unlimited supply of replacement animals upstream and downstream from where the damage is occurring. Until a regional nutria docontrol strategy is adopted, rapid immigration coupled with a high reproductive rate makes population control a labor intensive and often ineffective method of damage control. Exclusion is often the best long term solution to nutria damage.
Aedes sp. and others (Mosquitoes)

Background
Mosquitoes, many of which are non-native species, breed in wetlands, slow moving waterways, drainage ditches, and in many other bodies of standing water and are a source of concern to many residents. In some cases, these concerns give rise to complaints and requests for action from District staff.

Management Options

Habitat Reduction: Early season control activities are typically limited to breeding site reduction efforts since reducing the adult mosquito population directly reduces the chances of mosquito-borne disease transmission later. Eggs are laid in still waters (ponds or containers), and therefore control efforts should be directed at these places. The safest and most useful approach is to prevent mosquito breeding by eliminating unnecessary pools of water, maintaining swimming pools, catch basins, birdbaths, etc..

Biological/Other Controls: Biological control of mosquitoes using Gambusia affinis, a top minnow that feeds on mosquito larvae, has proven successful in many ponds and other permanent bodies of water. However, Gambusia may compete with native fish and amphibian species and should not be released where there is a risk of escape to natural waterways. Permission must be obtained from Oregon Department of Fish and Wildlife before they are introduced.

Chemical Control: Conventional insecticides should be used only after steps have been taken at source reduction and biological control. Because mosquitoes breed only at the edges of large bodies of water, treatment can be confined to these edges.

Agnique is a monomolecular light viscosity oil that spreads quickly and evenly over water, interferes with the larval mosquito's ability to obtain oxygen from the surfaces of the water. Agnique also suffocates all other surface breathing invertebrates and has been known to cause matting of duckling feathers.

Bacillus thuringiensis var. israelensis Bti serotype H-1 4 is a biologically derived insecticide for mosquito control. It is an endospore-forming bacterium which must be ingested by the larvae. Bti is most effective on young larvae. Its
effectiveness is reduced in highly turbid (highly organic) waters and it is known to kill midges, an important food source for fish and waterfowl.

Methoprene insecticide (e.g., Altosid). An insect growth regulator (IGR), which acts by inducing morphological changes interfering with normal development. Little is known about its impacts on fish.

It is crucial to use the above chemicals at the correct rate, as overuse may kill a wide range of aquatic invertebrates.

**Recommended Actions**

Educational campaigns should focus on reducing mosquito breeding in unnecessary pools of water in residential, commercial, and industrial areas. In general, Storm Water facilities should be managed to maintain a healthy balance of aquatic life, including mosquito larvae and the organisms that feed on them. The District relies on outside contractors for abatement of mosquito-borne diseases.

With the expected arrival of the West Nile Virus, an increase in calls from the public is anticipated. Detailed measures for controlling the virus are presented in a separate document, the *West Nile Virus Response Plan*. In the Pacific Northwest, the Northwest Mosquito and Vector Control Association is a source of information on local vector control problems.