Jones & Stokes

St. Johns Landfill

Conceptual Landfill Vegetation and Wildlife Habitat Management Plan

March 2004

INTRODUCTION

Metro is assessing ways to improve the vegetative cover of St. Johns Landfill (SJL), its 238-acre North Portland (Oregon) facility near the confluence of the Columbia and Willamette Rivers and within the Smith and Bybee Lakes Wildlife Area. Since the early 1990's, several attempts have been made to determine methods by which native grasses and forbs could be used to replace or be integrated with existing, less desirable vegetation. The overall goal was to develop vegetation that was protective to the landfill and the environment, cost-effective to install, would minimize maintenance, enhance existing habitat, and improve aesthetics (Metro 1997). This basic goal has not changed significantly since it was expressed: The first and foremost role of vegetation remains the protection of the landfill, its associated facilities, and the environment. This portion of the goal has generally been met, though adding native components has been difficult. However, Metro is moving forward using knowledge from previous activities and other research that will take a different approach to vegetation management, while retaining the same basic goal.

BACKGROUND

The landfill was first covered during the 1980's. Cover consisted of a layer of soil that was approximately two feet thick planted with eight non-native species of grasses and legumes, which provided good erosion control and were suitable for grazing. Beginning in 1989 with the issuance of the *Revised Closure and Financial Assurance Plan for St. John's Landfill*, a new multilayer liner system was implemented. Construction of landfill closure cover was completed sequentially for each of the landfill's five sections or "Sub-Areas" between 1992 and 1996. As cover for each sub-area was constructed, various planting strategies and/or experimental designs were implemented. In 1990, the landfill was included in the newly formed Smith and Bybee Lakes Management Area. A bulleted summary of these activities, their outcome, and any knowledge gained follows. More detailed descriptions of these activities may be found in reports completed by and for Metro (Metro 1997, Wilson et al. 1998, Wilson et al. 1999), particularly Wilson et al. 1998.

- 1992-1993 – A plan was developed (Fishman 1992) to prepare a weed-free seedbed for Sub-Area 1 and plant with native species. A survey of soil types and depths was performed for the approximately 30 acres of the Sub-Area 1. A simple design was also implemented to evaluate techniques for soil preparation, seeding, and the use of two seed mixes based on landscape hydrology and position (i.e., mesic versus xeric). Both the overall planting and the evaluation of planting techniques and materials were confounded by imported soils with seed

banks rich in non-native species. Several species of shrubs were also planted but survival was poor and complicated by deer and sheep herbivory.

- 1993 & 1994 –. Sub-Areas 2 and 3 were planted with sterile wheatgrass on low fertility soils in 1993 and 1994, respectively. Due to poor growing conditions during the fall and a host of other factors, significant erosion occurred. This heightened Metro's awareness of the risk of erosion during such undertakings.

- 1994 – An experiment involving a series of eight un-replicated test plots was conducted in 1994 to examine a series of different planting and rye grass management treatments. Results were mixed but pre-treating solarization was found to improve recruitment of native grasses.

- 1995 – A test plot was established in Sub-Area 5 and blue wildrye (*Elymus glaucus*[1]) was planted and fertilized in unprepared soils. Results were confounded by herbivory and being mowed before it could drop seed. In any case, blue wildrye comprised only about fifty percent of the stand, rye grass being at least co-dominant.

- 1996 – In 1996, three test plots were established in several areas in and around Sub-Areas 4 and 5 using sterile soils mixed with sewage sludge and fertilizer. California brome and blue wildrye were used. In 1997, these plants were evident but not dominant.

VEGETATION MANAGEMENT CONSIDERATIONS

As a closed, yet actively managed facility, St. John's Landfill poses challenges for landscape management. Facilities such as roads, gas and monitoring well headers, and structures, as well as access to these facilities or the landfill as a whole, for monitoring or general maintenance, may potentially conflict with vegetation and wildlife habitat management. Some of the main constraints include, but are not limited to the following:

- The landfill cover liner must remain intact. Large plants (e.g., trees) that have tap root systems that could promote wear or damage to the liner, or that might encourage the presence of burrowing animals that could penetrate the liner, must be avoided. Plant density must provide adequate erosion control to prevent the transport of soil into surface waters as well as landfill liner exposure and damage.

- Vegetation and wildlife habitat planning and implementation must consider landfill infrastructure, including but not limited to roads, power lines, buildings, gas collection systems, and stormwater facilities. Some facilities may require buffering or other consideration with regard to some plan elements, e.g., possible conflicts between mowing and fire control.

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[1] A comprehensive list of plants that occur on and in proximity to St. John's Landfill is included as Appendix X. Note that not all species have accepted common names. Where such species are cited in the document, only scientific names will be used.

- Gas facilities must be accessible and protected from harm, including risk of fire. Vegetation must provide erosion control and other services without causing unacceptable risk to the integrity of the gas system (e.g., horizontal surface pipes and headers) or posing a significant fire hazard. Zones or perimeters associated with maintenance of gas facilities must be considered so that conflicts with vegetation do not arise, e.g., well drilling equipment or equipment used to move pipe encountering significant vegetation (e.g., shrubs) or non-mobile, artificial habitat elements within the needed work footprint or path. Vegetation must also be managed in a way that allows routine monitoring of the landfill surface for gas leaks.

- Groundwater monitoring wellheads must be accessible for monitoring and maintenance and protected in much the same way as gas facilities, though to a lesser degree. Vegetation must not prevent access to wellheads or monitoring.

- Vegetation management plans and practices must adhere to Metro's Integrated Pest Management Policy. Prior to conducting weed control, staff will prepare a pest management plan that includes a review of the plant's life cycle, a quantifiable monitoring program, and options for control (including alternatives to using herbicides, pesticides, and similar materials).

- Metro policies regarding sustainability must be considered as part of vegetation and wildlife habitat planning. While the methods suggested here carry a relatively low environmental burden, opportunities do exist to include "recycled" materials in the proposed structures. Less mowing will also greatly reduce fuel use, related emissions, and equipment use.

GOAL AND OBJECTIVES FOR VEGETATION MANAGEMENT

This plan is somewhat different than previous vegetation management plans in that it more directly addresses wildlife habitat rather than just vegetation: Vegetation management is used as a means to improve wildlife habitat, rather than addressing only the native versus non-native vegetation issue. The planning team (Metro and Jones & Stokes) has also decided that future management should favor a grassland setting, in that 1) the management plan calls for the landfill to be managed as a meadow, 2) large areas of uncultivated grassland are not particularly common in the Metro area, and 3) such areas may provide habitat for grassland species that have been nearly extirpated from the Willamette Valley.

The basic method of this plan is to 1) understand the site in its current condition and determine conditions that optimize its value as wildlife habitat, then 2) augment or alter the site in ways that promote wildlife and habitat composed of native plants, consistent with management objectives regarding health and safety. To that end, the current landfill vegetation team has established new goal and objective statements to help guide the process:

GOAL: Establish a landfill cover with a diversity of plant species and structural components that encourage grassland wildlife use, are protective of landfill infrastructure and the environment, and that minimize maintenance.

Management Objectives

1. ***Develop a St. John's Landfill Vegetation Management Plan (VMP) with the following elements:***
    - A grassland-based vegetative landfill cover that encourages and supports native grassland plant (grasses and forbs, with occasional shrubs and small trees) and animal (e.g., northern harrier, western meadowlark) species and discourages noxious weeds.
    - A set of modular designs for structural elements, both natural (e.g., shrub islands, rock piles, etc.) and artificial (e.g., perching stands, nesting boxes), that will increase wildlife habitat focusing on grassland species.
    - A schedule and methods for periodic vegetation management, including mowing, weed control, and planting.
2. ***Ensure that the plan will facilitate cost-effective and sustainable management of the landfill cover, while minimizing risks to public health and safety, and the environment.***
    - Ensure that the plan will prevent erosion or other potential sources of vegetation-related damage to the landfill liner system.
    - Ensure that the likelihood of vegetation-related damage to the landfill gas system, monitoring wells, and other infrastructure is minimized.

CURRENT CONDITON

Jones & Stokes assessed the current condition of the landfill by reviewing reports of past activities and current information during several spring and summer site visits. Robert Altman, a noted ornithologist, attended one of the visits (August 13, 2003) to address current and potential habitat suitability for grassland birds, particularly western meadowlark and horned lark. A map of the various cover forms (Figure 1) as evidenced in the current aerial photo and on the ground has been created and annotated. The following discussion qualitatively addresses the current state of the landfill cover with regard to the aforementioned wildlife habitat and vegetation management goal.

Species Composition and Structure

The landfill cover vegetation is composed of a mosaic of grass, forb, and shrub species that form loosely defined communities (see Appendix A for plant list). Appendix 2 of Wilson et al. 1998 still provides a good summary of current conditions. Though some areas may have changed due, for instance, to hydrological changes, the same basic vegetation assemblages still exist. The following is a general list of landfill vegetation communities:

A) Perimeter slopes generally contain large, dense stands composed mostly of annual and perennial ryegrass (non-native grasses). While not a native community, these grasses provide a high level of erosion control and surface stability for these sensitive areas. Other dominant species that occur in these areas may include but are not limited to colonial bentgrass (*Agrostis tenuis*), velvetgrass (*Holcus lanatus),* and various leguminous forbs (e.g., *Vicea* spp.).

B) Many of the more open, dryer, flatter areas tend to exhibit a higher species and structural diversity than slopes, being composed of a number of native and many naturalized, non-native species. Dominant species, all non-native, include *Bromus japonicus*, *B. hordeaceus*, and colonial bentgrass.

C) Areas that received past planting of native species, particularly areas 2E, 3N, and 3S, are generally composed of species in 2 above, with traces of the planted native California brome (B. *carinatus)* and blue wildrye (blue wildrye tends to occur only where there is increased hydrology, e.g., along ditch edges or ponded areas, and where heavier soils tend to hold moisture for longer periods). These areas also tend to have a more open structure, forming a mosaic of bare ground with varying degrees of cover, including a variety of other graminoids and forbs. This phenomenon seems to be related to disturbance(s) associated with the various experimental/restoration treatments these areas received and is clearly evident in aerial photos taken during the spring (Figure 1).

D) Wet areas are fairly rare on the landfill cover and are kept at a minimum to help ensure cover integrity. However, there are many drainage ways, ditches, and incidental ponded areas that provide valuable habitat for plants and wildlife. It is these areas that can have some of the greatest potential for both native and, unfortunately, non-native species such as reed canary grass *(Phalaris arundinacea*). Several seasonally inundated areas host a variety of native plants and provide very good habitat for shorebirds. Other areas usually associated with longer hydroperiods, such as ditches, tend to harbor non-native stands comprised mostly of reed canary grass and meadow foxtail (*Alopecurus pratensis*). Observation in the field and communications with landfill personnel indicate that maintaining shallow seasonally ponded areas may be a possibility, while the latter situation involving drainage ways is simply an on-going consequence of the landform. It should be noted that while undesirable, reed canary grass, though an invasive non-native, does provide good erosion control.

In summary, the landfill is a mosaic of at least the four major vegetation communities outlined above, plus the many transitions, between communities. Non-native grasses dominate all four communities. Structure, function, and visible species composition may vary by season, month, or variation in weather. For instance, many native grasses emerge later in the season than non-natives, e.g., blue wildrye is generally only apparent after June.

Function and Value of Plant Species and Communities

Plants, whether native, non-native, weedy, invasive, or a combination of these, provide functions and have value in the communities in which they exist. Communities composed of these species also provide functions and have values, though on a larger scale. Functions and values may be positive or negative, and may affect the ecosystem in various ways. There are several aspects of function that one might consider as we evaluate the current landfill cover and plan future projects. Examples of two of these are listed here:

1. Some species that would normally be considered invasive or potentially invasive (e.g., reed canary grass, thistles, poison hemlock, etc.) do not currently seem to pose a significant risk at a landscape level, at least for the landfill. This is mainly because they tend to be constrained by hydrological regimes, soil types, or other differences in the landfill cover. In limited quantities, some of these species may provide valuable habitat elements for wildlife until such time as they may be replaced with native elements. However, due mainly to the proposed cessation of heavy mowing, some species (e.g., blackberry, thistles, etc.) may pose greater challenges to control. These species may also pose potential detrimental effects to adjacent areas (e.g., Smith and Bybee Lakes). Therefore, the positive

and negative attributes of each of these species should be evaluated, and the appropriate management priority and methods established for each.

2. Flowering forbs are relatively uncommon on the landfill. Those that do exist tend to be non-native plants associated with areas of human disturbance that tend to out-compete native species. Both native and non-native forbs may contribute valuable resources for wildlife. For instance, oxeye daisy *(Chrysanthemum leucanthemum)* and teasel *(Dipsacus fullonum)* provide valuable seed and nectar sources for many birds and insects. While native analogues are preferred, these and similar species may continue to provide resources until such time as they may be replaced with natives. In any case, it is likely that these species *will* continue to occur on the landfill for the foreseeable future and should be evaluated as to their value or risk and dealt with appropriately.

PROPOSAL

The following is the proposed preliminary approach to meeting the goals and objectives outlined above. This approach is based on the premise that a number of small pilot projects will be used to form the basis of a broader project or set of projects, the scope and phasing of which will ultimately depend on available resources with which to implement them. Thus, the final vegetation management plan will be designed to be modular and scalable so that Metro may maintain flexibility in implementation.

Vegetation Management

The landfill is already in the process of implementing a refined vegetation management plan and schedule. Previously, landfill staff mowed a large portion of the landfill's grassy areas and practiced vigorous weed control. The revised plan involves the following elements:

Mowing

Vegetation Structure - Personnel will mow only those areas associated with landfill infrastructure maintenance and monitoring, or where mowing is prescribed for weed control. The absence of mowing over much of the landfill will allow grasses and forbs to attain their mature heights and thereby provide greater vegetative structural (vertical and local horizontal) diversity. Additionally, mowing will provide a modicum of lower, more open areas that some species will likely find advantageous. While the majority of resulting structural diversity occurs within the herbaceous scale, between approximately 2 inches and 4 feet, such small differences in height are often significant to grassland wildlife.

Vegetation Composition – Reduced mowing will allow grasses and forbs to grow to fruition, providing food and structural habitat throughout their life history. For instance, plants may produce foods for various wildlife that might include any plant part, both vegetative (e.g., roots, root crown, stem, leaves, thorns, etc.) and reproductive (e.g., flowers, pollen, seed, etc.). Portions of these plants might also provide critical hosting opportunities for invertebrates, as well as provide nesting materials for larger wildlife.

Vegetation Diversity – Long-term mowing and replacement seeding of non-native species has likely reduced the landfill cover's species richness and structural complexity. Reduced mowing will likely result in greater species richness. However, some of the new species may be desirable (e.g., natives) and some undesirable (e.g., invasive weeds, such as blackberry). Therefore, while less mowing may be required, focused promotion of natives and management of non-natives may result in the same or greater effort than

mowing. However, effort would now be spent directly on improving the plant community and associated wildlife habitat rather than on simply controlling vegetation.

Other Habitat Improvements

A number of designs are proposed to augment grassland community habitats. It is the opinion of Bob Altman, a recognized authority on grassland birds (particularly western meadowlarks), that the various wellheads and other landfill infrastructure provide adequate perch sites for grassland bird species. Therefore, several structures are described that may be used to augment existing perching opportunities where they may be scarce. In addition, three structures are described that will provide habitat for a variety of other species.

Low Perching Structures

Low perching structures constructed of wood may provide additional perching opportunities where they are currently scarce or where vegetation islands are not necessarily practical. They may also serve as a temporary solution until such time that a vegetation island might be established. These structures are simple, light, and moveable, allowing mowing or other management to take place by simply moving them aside.

Vegetation Islands

Islands of native vegetation have the potential to provide the most benefit to a variety of species. Constructed vegetation islands, such as that shown in Figure 2, may also serve as nuclei for larger areas of native grassland restoration. A preliminary list of species recommended for the islands is presented in Table 1 below, the final list being contingent on availability, suitability, or other considerations, as determined Metro. The list may be increased as soil and micro-climactic conditions will allow, as well as limitations of the Portland Plant List, which is currently in revision.

The islands will be constructed atop a counter sunk, impermeable liner that will hold water for a much longer period than the existing cover, which is designed to move water quickly off the landfill cover; it will also serve as a root barrier for island plantings. The island liner may be placed above the existing cover layer or preferably countersunk into the landfill cover soils, or a combination of the two. The liner will be filled to an even grade or slightly mounded to provide room for plants to root adequately. Shrubs will be placed toward the middle, deeper portion of the island, smaller grasses and forbs throughout and toward the outside edge.

The area surrounding the island may be further enhanced with plantings of native grasses and forbs from Table 1.

Table 1. Recommended species for vegetation islands at St. Johns Landfill

Common Name	Scientific Name	Cost (Bare root/ 1Gal.)
Shrubs		
oceanspray	*Holodiscus discolor*	*$4.50 / $6.95*
red-flowering currant	*Ribes sanguineum*	*$3.95 / $7.95*
blue elderberry	*Sambucus cerulea*	$4.25/ $7.95
serviceberry	*Amlelanchier alnifolia*	$6.75 / $6.95
snowberry	*Symphoricarpos alba*	$3.75 / $7.95
Grasses		(Seed per pound)
blue wild rye	*Elymus glaucus*	$15
California brome	*Bromus carinatus*	$10
prairie junegrass	*Koeleria macrantha*	$60
Roemer's fescue	*Festuca roemeri*	TBD 2004
Forbs		(Bare root/ 1Gal.)
pearly everlasting	*Anaphalis margaritaces*	-- / $8.00
yarrow	*Achillea millefolium*	--- / $6.00
milkweed	*Asclepias speciosa* *A. fascicularis*	$0.35 / ---
Giant blue-eyed Mary	*Collinsia grandiflora*	$45 per lb. seed
Bluefield gilia	*Gilia capitata*	$24 per lb. seed
Many-leaved lupine	*Lupinus polyphyllus*	
Cinquefoil	*Potentilla glandulosa* *P. gracilis*	
Self-heal	*Prunella vulgaris*	
Oregon iris	*Iris tenax*	$8.00

Rock and Brush Piles

Rock and brush piles are easy to install and provide habitat for a variety of reptiles, amphibians, small mammals, birds, and invertebrates. Rock piles tend to favor reptiles and amphibians by providing open basking areas and sheltering interstices that are easy to access. Brush piles tend to favor small mammals and birds. Both provide excellent habitat for invertebrates. Care should be taken in the placement of these features in that they could provide habitat for many of the species that would pray on the eggs or young of ground-nesting birds.

Rock piles may be of any size and constructed of a variety of materials. The rocks should be of a variety of sizes (2 inches and larger), and of shapes and hardness sufficient to preclude compaction, both of which will result in the loss of interstitial habitat.

Brush piles are generally constructed in two parts: a base and a cover. The base should be constructed of courser rock (10 inches and larger) and/or woody materials, such as larger trunks, limbs, stumps, and root wads. Hardwoods should be favored to ensure a reasonable amount of time before the base breaks down, typically 15 years or more. The base should be fashioned to partly support the brush cover so that a variety of interstices are formed. The cover may be composed of any number of smaller materials.

Care must be taken to ensure that the landfill liner is not damaged during or after installation of these structures. Piles should be considered permanent in that moving them will reduce much, if not all, habitat value for at least the current season and likely longer. Thus, like the vegetation islands, they should be placed in areas where infrastructural management is expected to be minimal.

With regard to specifications, we recommend that landfill staff assess pile materials as they become available in an effort to re-use existing materials and thereby promote sustainability.

Wildlife-Friendly Infrastructure

Metro may want to consider conducting an assessment of existing (and possibly planned) structures with regard to possible effects to wildlife. For instance, bird-friendly power lines may be used to replace older style power lines when the latter are due for service or replacement. Likewise, if particular areas seem to attract species which Metro would like to encourage on the landfill, then special consideration may be given these areas, in the form of special signage, structures, or protection.

EXPECTED MANAGEMENT EFFORTS

This plan has been designed to be scalable to meet Metro's needs based on available resources: Habitat structures may be developed in varying numbers and, in some cases, varying size (e.g., vegetation islands and brush piles). However, the pricing estimate schedule below is based on what we consider a basic size for each structure, with consideration of recycled materials being used, which would likely reduce cost. We also suggest a number of hours a single person would likely take to complete each structure, along with the cost of large equipment, if applicable.

Table 2. Estimated costs for habitat structures.

Structure	Cost	Labor
Low perching structures	$20-$100 (wood)	2-6 hrs
Vegetation Islands	$ 40 (4 bare root shrubs/seed)	24 hrs (2 people, bobcat)
Topsoil, Compost	$25/yd, $18/yd ($35 for delivery)	
Liner	Free (assume available)	
Irrigation	Free (assume available)	1 hr weekly during summer/fall for 2+ years (with water truck)
Rock pile	$28 / $119 delivered. (rock)	1 hr (dump truck)
Brush pile	Free (assume refuse/reuse)	4-8 hrs (2 people, bobcat)

INVASIVE SPECIES CONTROL

See attached Appendix B for Invasive Species Control Plan.

SCHEDULE

Most structures may be constructed during any part of the year, though it may be best to construct/place during the fall, so as to not disrupt spring breeding. We suggest preparing, grading, and seeding vegetation island during the fall prior to the onset of rain and planting shrubs mid winter (December through February).

SUGGESTED PLANT MATRERIAL VENDORS

Triangle Farms (seed)
5648 Evans Valley Rd.
Silverton, OR 97381
503-873-5190

Pacific Northwest Natives (seed)
1525 Laurel Heights Drive Northwest
Albany, Oregon 97321
(541) 928-8239
Fax: (541) 924-8855
Email: cwe@proaxis.com

Northwest Native Plants (container, bare root)
2158 Bower Ct S.E.
Salem, Oregon 97301
(503) 581-2638
Fax (503) 581-9957
E-Mail: plants@nwplants.com

Balance Restoration Nursery
(wholesale, bare root stock only)
27995 Chambers Mill Rd.
Lorane OR 97451
541-942-5530

Native Seed Network (many vendors)
www.nativeseednetwork.org

Portland BES
Toby Query
503-823-4205

SOIL TESTING

A&L Western Agricultural Laboratories
10220 SW Nimbus Ave., Bldg. K-9
Portland, Oregon 97223
(503) 968-9225

TOPSOIL & COMPOST

American Compost and Recycling
9707 Columbia Blvd.
Portland, Oregon
(503) 286-0886

A list of all analytical testing labs in Oregon is available at http://wwwagcomm.ads.orst.edu/AgComWebFile/EdMat/EM8677.pdf.

REFERENCES

Fishman Environmental Services (Fishman). 1992. St. John's Landfill Cover Vegetation Plan, Final Report. August 1992.

Metro. 1997. Native Vegetation at St. Johns Landfill. Metro. 15 pp.+

Wilson, M.G., L. Brophy, L. Wilson. 1999. Establishment of Native Vegetation at St. Johns Landfill, Experimental Test Plot Monitoring. Metro. 5 pp. +.

Wilson, M.G., L. Brophy, L. Wilson. 1998. Establishment of Native Vegetation at St. Johns Landfill, Final Report. Metro. 48 pp. +.

REPORT FIGURES

Legend

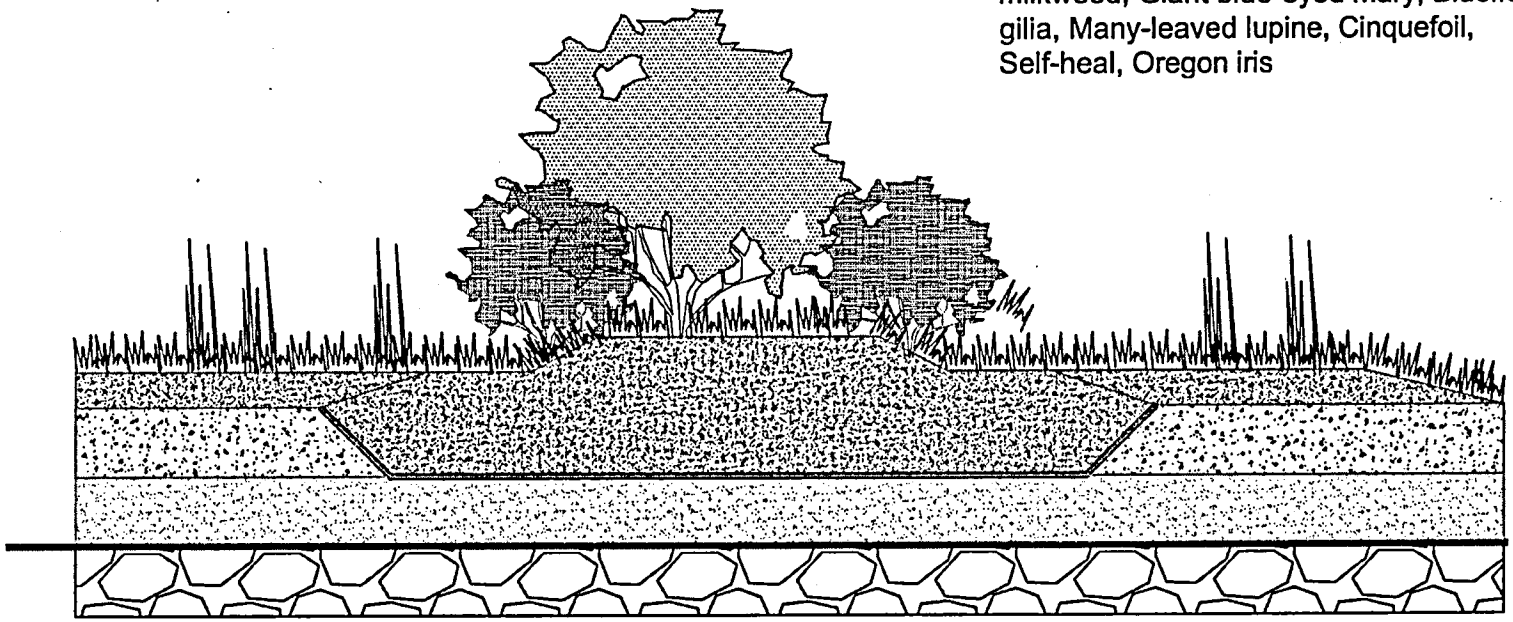
A - Rye-Dominated Grasslands
B - Open, Dryer Areas
C - Past Treatment Areas
D - Vernally Wet or Ponded Areas

NOT FOR CONSTRUCTION

Jones & Stokes 317 SW Alder Street, Suite 800 Portland, OR 97204	METRO	Vegetation and Habitat Map	St. Johns Landfill METRO	Xrefs. Author: S. Lattimer Mar 05, 2004 – 2:38pm G:\Projects\03188.03 – St. Johns Landfill\CAD\Veg Map.dwg X-Ref Files: Image Files: 11Mar98.tif metro.bmp	FIGURE NO. 1 PROJECT NO. 03137.03

Shrubs
Inner: oceanspray, blue elderberry, serviceberry
Outer: red-flowering currant, snowberry

Grasses & Forbs
Grasses: blue wild rye, California brome, prairie junegrass, Roemer's fescue
Forbs: pearly everlasting, yarrow, milkweed, Giant blue-eyed Mary, Bluefield gilia, Many-leaved lupine, Cinquefoil, Self-heal, Oregon iris



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1/10/03

St. Johns Landfill
Portland, Oregon

DIAGRAM OF PROPOSED VEGETATION ISLAND

Jones & Stokes

APPENDIX A

PLANT LIST

A list of plants noted on the St. Johns Landfill
during 2003 and by Wilson et al. 1998

LAYER	*SCIENTIFIC NAME*	COMMON NAME
F	*Achillea millefolium*	yarrow
F	*Allium vineale**	field garlic
F	*Anthemis cotula**	mayweed
F	Anthriscus *scandicina**	bur chervil
F	*Arctium* sp*	burdock
F	*Bidens* sp	beggars-tick
F	*Brassica campestris**	field mustard
F	*Capsella bursa-pastoris**	shepherd's-purse
F	*Chenopodium album**	lambsquarter; white goosefoot
F	*Chenopodium botrys**	Jerusalem-oak
F	*Chrysanthemum leucanthemum**	ox-eye daisy
F	*Cichorium inrybus**	chicory
F	*Cirsium arvense**	Canada thistle
F	*Cirsium vulgare**	bull thistle
F	*Conium maculatum**	poison-hemlock
F	*Convolvulus sepium**	hedge bindweed
F	*Crepis capillaris**	smooth hawksbeard
F	*Crepis setosa**	rough hawksbeard
F	*Daucus carota**	Queen Anne's lace
F	*Dipsacus sylvestris**	teasel
F	*Epilobium angustifolium*	fireweed
F	*Epilobium paniculatum*	autumn willow-weed
F	*Epilobium watsonii*	Watson's willow-weed
F	*Equisetum arvense*	common horsetail
F	*Erodium cicutarium**	filaree
F	*Galium parisiense**	wall bedstraw
F	*Geranium dissecrum**	cut-leaf geranium
F	*Geranium molle**	dovefoot geranium
F	*Gnaphalium palustre*	marsh cudweed
F	*Gnaphalium uliginosum**	low cudweed
F	*Hypericum perforatum**	St. John's wort
F	*Hypochaeris radicata**	hairy cat's-ear
F	*Lactuca serriola**	prickly lettuce
F	*Leontodon nudicaulis**	hairy hawkbit
F	*Lichnis alba**	white campion
F	*Lotus corniculatus**	bird's-foot trefoil
F	*Lotus purshianus*	Spanish clover
F	*Lupinus sp.*	lupine
F	*Madia sativa*	coast tarweed
F	*Marricaria matricarioides*	pineappleweed
F	*Medicago sativa**	alfalfa
F	*Melilolus alba**	white sweet-clover
F	*Oenothera strigosa*	common evening-primrose
F	*Parentucellia viscosa**	yellow parentucellia
F	*Phacelia nemoralis*	woodland phacelia
F	*Planiago lanceolata**	English plantain
F	*Planiago major**	nippleseed plantain
F	*Plantago psillium**	sand plantain
F	*Polygonum aviculare*	prostrate knotweed
F	*Polygonum persicaria*	lady's-thumb
F	*Ranunculus sceleratus*	celery-leaved buttercup
F	*Raphanus sativus**	wild radish
F	*Rorippa curvisiliqua*	curve-pod watercress
F	*Rumex acetosella**	sheep sorrel
F	*Rumex conglomeratus**	clustered dock
F	*Rumex crispus**	curly dock

LAYER	*SCIENTIFIC NAME*	COMMON NAME
F	*Rumex obtusifolius**	bitterdock
F	*Senecio jacobaea**	tans ragwort
F	*Senecio vulgaris**	common groundsel
F	*Silybum marianum**	blessed thistle; milk thistle
F	*Sisymbrium officinale**	hedge mustard
F	*Solidago canadensis*	Canada goldenrod
F	*Sonchus asper**	prickly sow-thistle
F	*Sonchus oleraceus**	common sow-thistle
F	*Tanacerum vulgare**	common tansy
F	*Taraxacum officinale**	dandelion
F	*Trifolium arvense**	rabbit-foot clover
F	*Trifolium dubium**	least hop clover
F	*Trifolium fragiferum*	strawberry clover
F	*Trifolium hybridum**	alsike clover
F	*Trifolium pratense**	red clover
F	*Trifolium procumbens**	hop clover
F	*Trifolium repens**	white clover
F	*Urica dioica**	stinging nettle
F	*Verbascum blattaria**	moth mullein
F	*Verbascum thapsus**	flannel mullein
F	*Veronica arvensis**	common speedwell
F	*Vicia cracca**	cat peas
F	*Vicia hirsuta**	hairy vetch; tiny vetch
F	*Vicia sativa**	common vetch
G	*Agropyron repens**	quackgrass
G	*Agrostis exarata*	spike bentgrass
G	*Agrostis scabra*	winter bentgrass; tickle8rass
G	*Agrostis stolonifera**	spreading bentgrass
G	*Agrostis renuis**	Colonial bentgrass
G	*Alopecurus geniculatus*	water foxtail
G	*Alopecurus pratensis**	meadow foxtail
G	*Anthoxanthum odoratum**	sweet vernalgrass
G	*Bromus carinatus*	California brome
G	*Bromus hordeaceus** (*Bromus mollis*)	soft brome
G	*Bromus japonicus**	
G	*Bromus diandrus** (*Bromus rigidus*)	rip-gut brome
G	*Bromus secalinus**	ryebrome
G	*Bromus sterilis**	barren brome
G	*Bromus tecrorum**	cbeat grass
G	*Carex feta*	green-sbeathed sedge
G	*Carex pachystachya*	thick-beaded sedge
G	*Carex unilateralis*	one-sided sedge
G	*Dacrylis glomerata**	orchardgrass
G	*Deschampsia cespitosa*	tufted hairgrass
G	*Echinochloa crusgalli**	barnyard grass
G	*Elymus glaucus*	blue wildrye
G	*Festuca arundinacee*	tall fescue
G	*Festuca megalura**	fox-tail fescue
G	*Festuca myuros**	rat-tail fescue
G	*Glyceria occidentalis*	mannagrass
G	*Holcus lanatus**	common velvetgrass
G	*Holcus mollis**	creeping velvetgrass
G	*Hordeum geniculatum**	Mediterranean barley
G	*Hordeum jubatum*	fox-tail barley
G	*Hordeum murinum**	mouse barley

LAYER	*SCIENTIFIC NAME*	COMMON NAME
G	*Juncus bufonius*	toad rush
G	*Juncus effusus*	soft rush
G	*Juncus tenuis*	slender rush
G	*Lolium mulfiflorum**	Italian ryegrass
G	*Lolium perenne**	perennial ryegrass
G	*Phalaris arundinacea*	reed canarygrass
G	*Phleum pratense**	timothy
G	*Poa annua**	annual bluegrass
G	*Poa pratensis**	Kentucky bluegrass
G	*Poa trivialis**	rough bluegrass
G	*Polypogon monspeliensis**	rabbit-foot grass
W	*Acer macrophyllum*	big-leaf maple
W	*Alnus rubra*	red alder
W	*Buddleja davidii**	butterfly-bush
W	*Cytisus scoparius**	Scot's broom
W	*Populus alba**	white poplar; silver poplar
W	*Populus trichocarpa*	black cottonwood
W	*Rubus discolor**	Himalayan blackberry
W	*Salix hookeriana*	Hooker willow
W	*Salx lasiandra*	Pacific willow
W	*Salix scouleriana*	Scouler willow
W	*Salix sessilifolia*	northwest willow
W	*Salix sitchensis*	Sitka willow
W	*Sambucus racemosa*	red elderberry
W	*Solanum dulcamara**	climbing nightshade