United States Air Force
11th Air Control Wing
11th Civil Engineering
Operations Squadron

Elmendorf AFB, Alaska

Revegetation Manual For King Salmon AFB King Salmon, Alaska

May 1994

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INTRODUCTION

SECTION 1

1.0 Introduction

The Alaska Plant Materials Center, a section of the Alaska Department of Natural Resources, Division of Agriculture, was contracted by the United States Air Force 11th Air Control Wing, 11th Civil Engineering Operations Squadron, Elmendorf AFB, Alaska, to produce this reference. This manual is intended to allow engineers and land managers flexibility and discretion in selecting proven techniques and materials for revegetation, vegetative erosion control and reclamation of disturbed land. The manual will also address limited landscaping practices associated with lawns and other maintained grass plantings.

1.1 Manual Layout

This manual has been designed to take the user through a series of logic charts to select the best methods and materials to be used at the specific location, installation or region. First, however, the user must have a basic foundation of information which can be drawn upon. This base will include the following topics:

A. Background

- Erosion control
- Restoration & Reclamation
- Habitat Plantings
- Landscape Plantings
- Special & Advanced Techniques
- Natural Revegetation

B. Basic Steps in Revegetation

- Planning
- Site Preparation
  - Requirements
  - Methods
- Seed Specifications
  - Species & Cultivars for Alaska
  - Species to be Avoided
  - Native Species
- Fertilizer
- Equipment
  - Broadcast
  - Drop
  - Drill
  - Hydroseeding
- Mulch & Erosion Netting
- Transplanting & Sprigging (Advanced Techniques)
- Natural Revegetation (Do Nothing)

C. Local Specifications

1.2 Changes in the Manual

When new information becomes available, corrections to this manual will be submitted to the Air Force. THESE MUST BE ENTERED AND CORRECTIONS NOTED ON THE MANUAL RECORD OF CHANGE, PAGE i.

A BACKGROUND IN REVEGETATION

SECTION 2

2.0 Background in Revegetation

Why revegetate an area? The reasons for revegetation are varied. This manual will address some of the commonly accepted reasons.

2.1 Erosion Control

Erosion control is based on the assumption that soil can be kept in place with a vegetative cover. The reasons to keep soil in place can include:

A. Protection of engineered grades
B. Reduction of maintenance on buildings, structures and other man-made objects
C. Maintaining quality of surface water
D. Visual enhancement

2.2 Restoration and Reclamation

These terms, often have legal implications and refer to returning a disturbed site to a condition similar to the site prior to disturbance. This concept is more nebulous than erosion control and is often the result of the following:

A. Request of the landowner or manager
B. Terms of development
C. Punitive actions; or
D. A desire by the creator of the disturbance

2.3 Habitat Plantings

Habitat plantings may be viewed as a form of reclamation, but instead of attempting to return the disturbed site to it's former condition, plantings are made to enhance the habitat of certain animal species. Instead, an animal species is targeted as the beneficiary of the planting. The reasons for habitat plantings are similar to restoration and reclamation, but are usually the result of the following:

A. Mitigation
B. Desire of the landowner
C. Desire of special interest groups

2.4 Landscape Plantings

Beautification or visual enhancement is probably the most common goal of vegetation plantings. These often require high levels of maintenance in order to sustain the desired appearance. This manual will only address lawns and playing fields. Landscape plantings are usually called for by design in the following situations:

A. Beautification/aesthetics
B. Safety-reducing fire hazard
C. Policy

Maintained landscapes are often used on military installations. The policy requiring highly manicured lawns and fields should be closely reviewed and compared to the cost of planting a more natural revegetation program.

2.5 Special Revegetation Techniques

Special or alternative techniques for revegetation use materials other than seed to provide a vegetative cover. Usually, these techniques rely on vegetative (cuttings and sprigs) or transplanting procedures. These alternatives should be carefully assessed prior to implementation. Costs can be considerably higher than seeding. However, in certain circumstances, these alternatives will provide the best results. This manual will only cover sprigging with grasses and willow planting techniques.

2.6 Natural Revegetation

With time, most disturbed sites will revegetate. However, very few landowners and managers find this revegetation approach acceptable. Surface preparation techniques and fertilization, natural reinvasion can hasten the invasion of native plants, but the process can take many years.

BASIC STEPS

IN REVEGETATION

SECTION 3

3.0 Basic Steps of Revegetation

3.1 Planning

The planning phase of any project should be the first step. In revegetation projects, planning is critical, since the designer is working with biological processes that have specific timing and environmental requirements.

In addition to identifying the type and purpose of revegetation, logistics must be given careful consideration. After the project contract is awarded, seed and plant materials should be purchased. This approach helps to ensure that the revegetation portion of the project can be completed while equipment and personnel are available.

Contractors should be aware that although at times cultivars have been difficult to obtain, some contractors have been known to say a particular cultivar is not available so that a less costly and often unsuitable seed could be substituted. If questions arise during this decision phase, contact local suppliers regarding availability or contact the State of Alaska, Department of Natural Resources, Plant Materials Center at (907) 745-4469.

3.2 Site Preparation

3.2.1 Site preparation methods are fairly standard for all forms of revegetation. An adequately prepared site will have the characteristics listed in Table 3.1.

Table 3.1

Conditions Required for Adequate Surface Preparation
1. Free of construction debris.
2. Relatively few large rocks or other natural objects.
3. Free of ruts or gullies.
4. Top two inches should be in a friable condition (non-compacted). Ideally, allowing a heel to make a 1/4 inch impression.
5. Heavily compacted sites should be scarified to a depth of 6 to 8 inches.

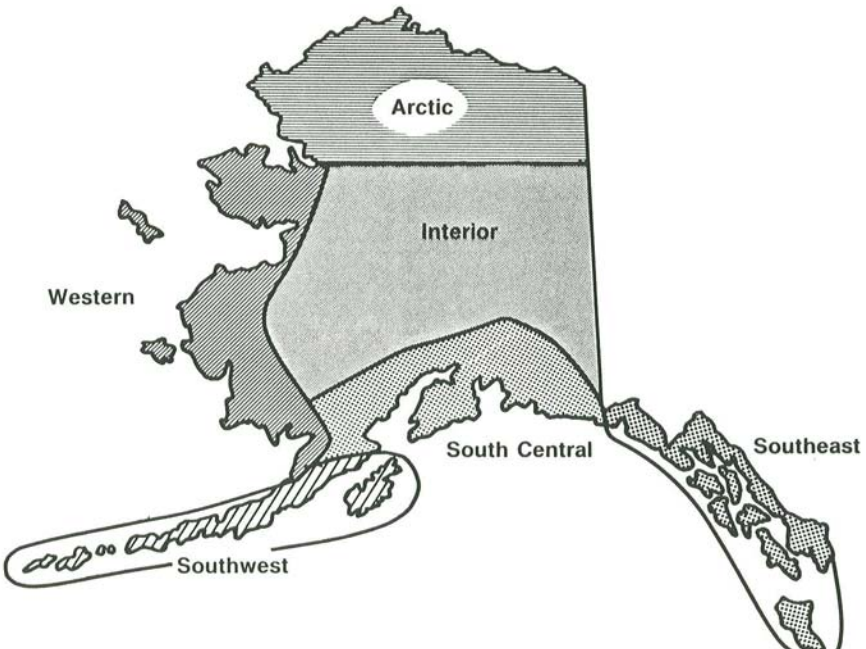
3.2.2 Methods of Preparation

With most construction activity, availability of soil preparation equipment is often limited and often can be accomplished with standard construction machinery. For example, ripper teeth on a grader tool bar will adequately prepare a site. Ideally, scarification will be done in two passes perpendicular to each other. However, on sloping land and in areas of high wind, mono-directional scarification perpendicular to the direction of slope or prevailing wind is preferred.

Table 3.2 Species/Cultivar Characteristic Chart

Species	Cultivar	Availability	Site Conditions Adaptation	Wetland Status or Other Comments
Red Fescue	Arctared	Very Good	Dry to Wet	Facultative
	Boreal	Excellent	Dry to Wet	Upland Facultative
	Pennlawn	Excellent	Dry to Wet	Upland Facultative
American Sloughgrass	Egan	Good	Wet	Obligate
Bering Hairgrass	Norcoast	Excellent	Dry to Wet	Facultative
Tufted Hairgrass	Nortran	1993 Poor	Dry to Wet	Facultative
Polargrass	Alyeska	Fair	Wetter Areas	Facultative
	Kenai	Fair	Wetter Areas	Facultative Wetland
Bluejoint	Sourdough	Poor	All	Facultative
Tilesy Sagebrush	Caiggluk	Poor	All	Upland
Glaucous Bluegrass	Tundra	Fair	North of Alaska Range, Dry	Upland
Alpine Bluegrass	Gruening	Fair	Dry	Upland
Kentucky Bluegrass	Nugget	Excellent	Lawns	Limit Use
	Park	Excellent	Lawns	Limit Use
	Merion	Excellent	Lawns	Limit Use
Timothy	Engmo	Good	Wet	Limit Use
	Climax	Good	Wet	Limit Use
Meadow Foxtail	-	Good	Wet	Limit Use
Brome	Manchar	Excellent	Dry	Upland
Beach Wildrye	Benson	Poor	Sandy, Dry	Coastal Dunes
	Reeve	Poor	Sandy, Dry	Coastal Dunes
Annual Ryegrass	-	Excellent	Dry, Limit Use	Limit Use
Perennial Ryegrass	-	Excellent	Dry, Limit Use	Limit Use

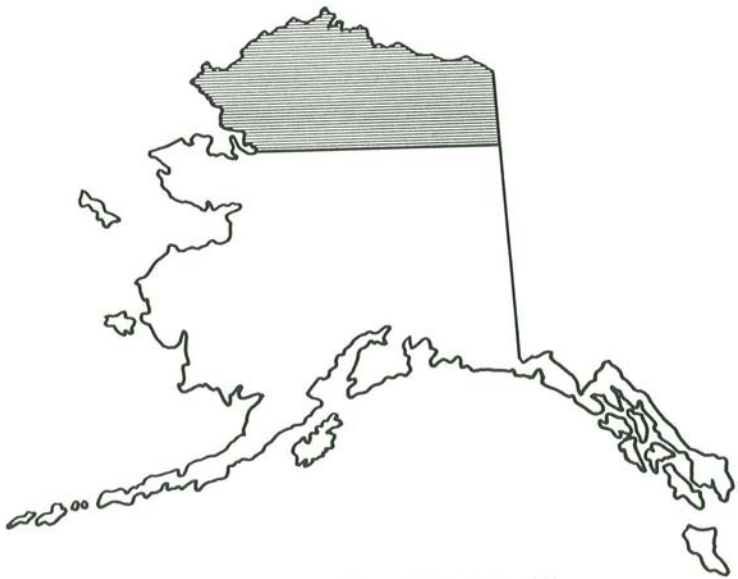
Table 3.3 **Revegetation Regions of Alaska**



Modified from Wright 1988

Table 3.3.1

Arctic Region
Revegetation Recommendations



Modified from Wright 1988

Cultivars Adapted For Use in Arctic Alaska
'Tundra' Glaucous Bluegrass
'Alyeska' Polargrass
'Arctared' Red Fescue
'Egan' American Sloughgrass
'Nugget' Kentucky Bluegrass
'Norcoast' Bering Hairgrass
'Nortran' Tufted Hairgrass
'Sourdough' Bluejoint

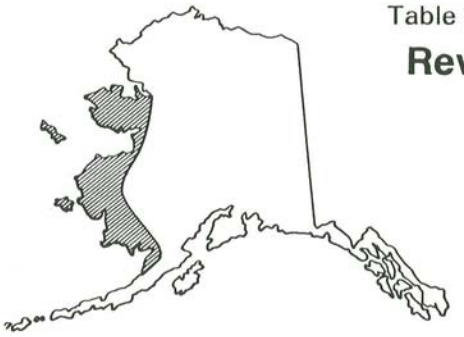


Table 3.3.2 Western Region Revegetation Recommendations

Cultivars Adapted For Use In Western Alaska
'Norcoast' Bering Hairgrass
'Nugget' } - Kentucky Bluegrass
'Merion' }
'Tundra' Glaucous Bluegrass
'Sourdough' Bluejoint
'Arctared' } - Red Fescue
'Boreal' }
'Egan' American Sloughgrass
'Alyeska' Polargrass
'Caiggluk' Tilesy Sagebrush
'Polar' Brome
'Manchar' Smooth Brome
'Benson' } - Beach Wildrye
'Reeve' }

Modified from Wright 1988

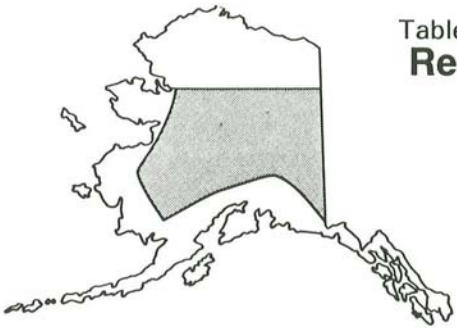
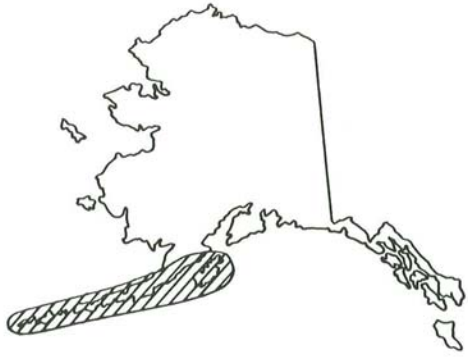


Table 3.3.3 Interior Region Revegetation Recommendations

Cultivars Adapted For Use In Interior Alaska
'Nugget' } - Kentucky Bluegrass
'Park' }
'Tundra' Glaucous Bluegrass
'Gruening' Alpine Bluegrass
'Engmo' Timothy
'Norcoast' Bering Hairgrass
'Nortran' Tufted Hairgrass
'Sourdough' Bluejoint
'Arctared' } - Red Fescue
'Boreal' }
'Alyeska' Polargrass
'Egan' American Sloughgrass
'Manchar' Smooth Brome
'Caiggluk' Tilesy Sagebrush

Modified from Wright 1988

Table 3.3.4 Southwestern Region Revegetation Recommendations



Cultivars Adapted For Use In Southwest Alaska	Preferred Cultivars For Alpine Areas In Southwest Alaska
'Norcoast' Bering Hairgrass 'Nortran' Tufted Hairgrass 'Boreal' } - Red Fescue 'Pennlawn'} 'Arctared' } 'Nugget' } - Kentucky Bluegrass 'Merion' } 'Sourdough' Bluejoint 'Meadow' Foxtail 'Reeve' } - Beach Wildrye 'Benson' }	'Arctared' } - Red Fescue 'Boreal' } 'Gruening' Alpine Bluegrass 'Norcoast' Bering Hairgrass 'Sourdough' Bluejoint

Modified from Wright 1988

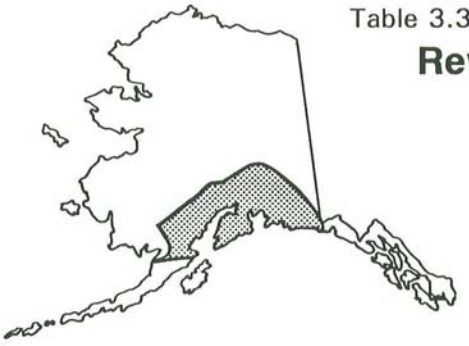


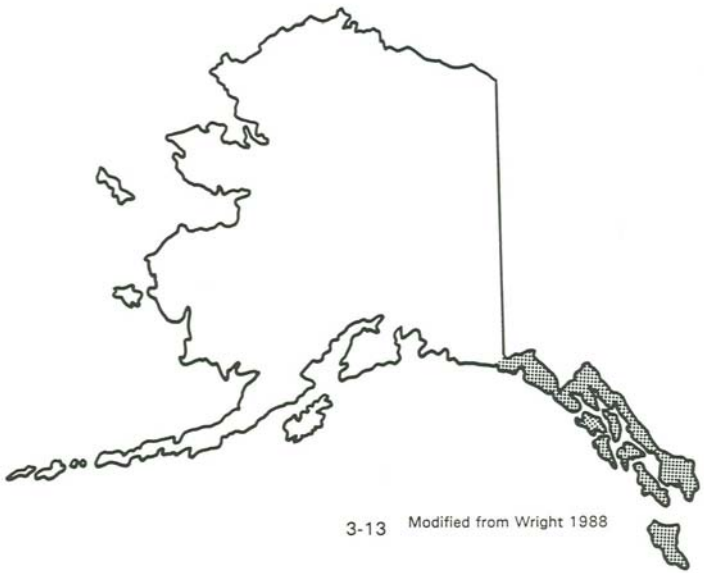
Table 3.3.5 Southcentral Region Revegetation Recommendations

Species And Cultivars For Use In Southcentral Alaska
'Nugget' } - Kentucky Bluegrass
'Park' }
'Merion' }
'Engmo' } - Timothy
'Climax' }
'Norcoast' Bering Hairgrass
'Nortran' Tufted Hairgrass
'Sourdough' Bluejoint
'Arctared' } - Red Fescue
'Boreal' }
'Pennlawn' }
'Manchar' Smooth Brome
'Alyeska' } - Polargrass
'Kenai' }
'Caiggluk' Tilesy Sagebrush
'Egan' American Sloughgrass
'Meadow' Foxtail
'Reeve' } - Beach Wildrye
'Benson' }

Modified from Wright 1988

Table 3.3.6 Southeast Region Revegetation Recommendations

Species & Cultivars for Use in Southeast Alaska
'Nugget' } - Kentucky Bluegrass
'Park' }
'Merion' }
'Arctared' } - Red Fescue
'Boreal' }
'Pennlawn' }
'Norcoast' Bering Hairgrass
'Nortran' Tufted Hairgrass
'Sourdough' Bluejoint
'Engmo' } - Timothy
'Climax' }
'Reeve' } - Beach Wildrye
'Benson' }
'Gruening' Alpine Sloughgrass
'Caiggluk' Tilesy Sagebrush
'Egan' American Sloughgrass
'Kenai' Polargrass



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3.3.2 Species to be Avoided

In most areas of Alaska, clovers should be avoided because they invade native plant communities. This is especially true in remote areas. Clover can be used near Fairbanks and Anchorage.

3.3.3 Native Species

Revegetation with native species is strongly encouraged. Federal agencies are directed to use native species by Executive Order 11987 (E.O.), Appendix B. This order does not specify germplasm source, however, species collected near a disturbance tend to be more biologically suited for revegetating the site.

The need to select more native species for revegetation on the Aleutian Islands and Alaska Peninsula provided the incentive to fund the seed collection program. Funding was also provided to prepare a manual which outlines revegetation practices with species that are currently available. The manual will be updated when new native species become available. A copy of the 1993 Native Plant Directory can be found in Appendix C.

Revegetation with native species provides the following advantages: they are better adapted and appear more natural than introduced species. Introduced species have the potential to escape into the natural environment. This problem has not occurred in Alaska, yet some introduced species have become well established; clovers are a good example.

The use of introduced species for lawns and playing fields is acceptable. In Appendix D, a list of new species, some of which should be available in 1996, is presented.

3.4. Fertilizer & Other Soil Amendments

3.4.1 Fertilizer

In all forms of revegetation, applications of fertilizer at the time of seeding is necessary. Most commercial fertilizers meet minimum standards and quality problems are seldom encountered. If problems arise with fertilizers, it can usually be traced to the product becoming wet during storage or shipment.

If possible, fertilizer should be applied at the same time or prior to seeding, because once the seed has been applied no additional traffic should be allowed on the site.

Fertilizer is described by a three digit designator; for example, 20-20-10. These numbers are percentages of three elements; nitrogen, phosphorus and potassium, respectively. Therefore, 20-20-10 fertilizer contains 20% nitrogen, 20% phosphorus and 10% potassium by weight.

3.4.2 Lime & Other Amendments to Adjust pH

Using adapted or native species will not require the use of lime or agents to acidify the soils. In testing throughout the state, amendments have never been needed to establish effective stands of vegetation, provided adapted or native species are used. The species and varieties called for in this manual will survive and produce effective stands without amendments.

Lawns and playing fields and other high maintenance may require lime if extremely lush growth is required. These areas will only benefit from such application if pH is lower than 5.0.

3.4.3 Topsoil

Gravelly sites tend not to be highly erodible and if some fines are present, can grow adapted species without topsoil. The addition of a layer of topsoil on the gravel surface could increase the erosion potential. The top layer of soil in undisturbed areas often is very thin and expensive to salvage. However, this layer is a source of native seed, plant propagules, organic matter and soil microbes which can enhance the quality of the substrate that is being revegetated. Often imported topsoil is a very peaty material and although it may look dark and rich, it does not provide a suitable growing medium.

3.5 Equipment Needs (Specialized)

Usually, equipment needed to complete a revegetation project is supplied by the contractor. This manual will include a section on equipment, in order to give the designer the advantages and drawbacks of each. This section has also been included to guide local commands if revegetation or vegetation maintenance programs are initiated by base personnel.

3.5.1 Broadcast Seeders

Broadcast seeders are usually the least expensive and require less training and support equipment. Broadcast type equipment can usually be used for both seed and fertilizer.

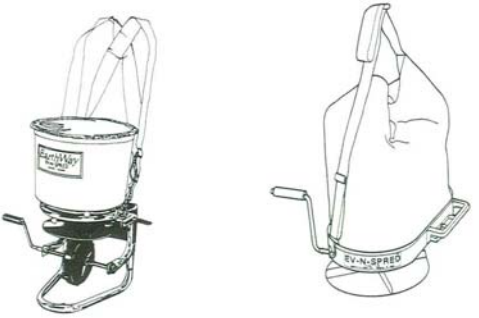


Figure 3.5.1 Spinner Type, Chest-Mounted

Drawings Courtesy of Earth Way

Figure 3.5.2 Spinner Type, Electric Spin

Photograph Courtesy of Herd Seeder

Figure 3.5.3 Spinner Type, PTO Driven

Photograph Courtesy of Herd Seeder

3.5.2 Drop Spreaders

Drop application methods rely on gravity feed, are simple in design and easy to use. Two problems can occur with this method; stripes can appear if the drop pattern is not overlapped and the equipment will corrode if it is not thoroughly cleaned after applying fertilizer. Stripes in lawn areas can be avoided by setting the spreader at 1/2 the recommended application rate and running two tracks perpendicular to each other over the site. Drop spreaders tend to be more precise than broadcast seeders.

Figure 3.5.4 Push Type Spreader, Drop Spreader
Photograph Courtesy of Gandy Corporation

Figure 3.5.5 Small Pull Type Drop Spreader

Photograph Courtesy of Gandy Corporation

3.5.3 Drill Seeders

Drill seeders, most often are used in agricultural settings. Only one drill seeder, the Brillion, has been used for revegetation of mine and construction sites. This seeder has been used on most soil types except very gravelly soils. Fertilizer cannot be applied with this seeder, however, the unit incorporates the seed into the soil, packs the seed in place and provides accurate application rates. The seeding rate can be reduced 50 percent.

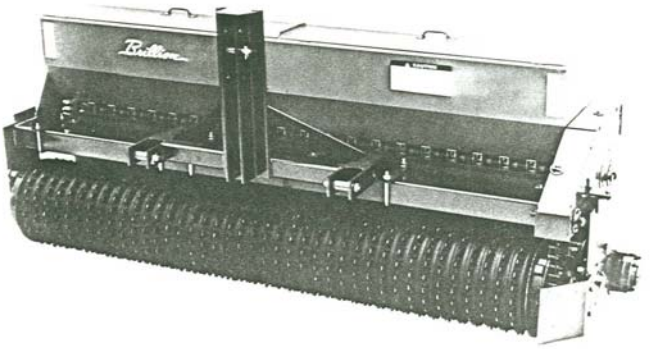


Figure 3.5.6 3-Point Brillion Drill Seeder

Photograph Courtesy of Brillion Iron Works

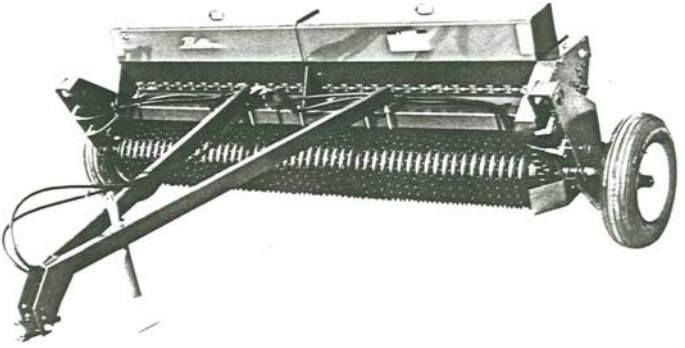


Figure 3.5.7 Pull Type Drill Seeder

Photograph Courtesy of Brillion Iron Works

3.5.4 Hydroseeding

In recent years, hydroseeding has been portrayed as the most effective means for revegetating an area. However, many professionals are finding that this claim is overstated. Hydroseeders are well suited for seeding steep slopes and rocky areas; and they apply mulch, seed, and fertilizer in one step. The primary disadvantage is the requirement for large quantities of water, which at times can result in numerous trips across the land that is being revegetated. The equipment is complex and mechanical problems can result in delays. Hydroseeder manufacturers have claimed that hydroseeding promotes more vigorous plant growth, however that claim has not proven to be true. Grass growth can be inhibited if too much mulch is applied.

Hydroseeders come in truck-mounted and trailer form. Major contractors either have a hydroseeder or can easily subcontract for one.

Hydroseeders are often used as supplemental watering trucks once seed has been applied. Additional watering is not always necessary to produce a good stand of vegetation; and it does cost more. Without additional watering, the seed will wait until there is sufficient moisture to germinate.

A hydroseeding contract should state that seed will not remain in the hydroseeder for more than one hour. This practice will prevent seed from absorbing excessive water and being damaged by the dissolved fertilizer.

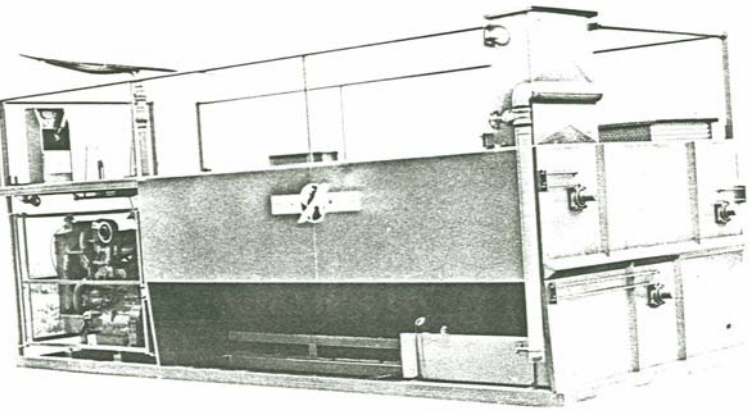


Figure 3.5.8 Truck mounted Hydroseeder Assembly

Photograph Courtesy of Bowie Hydroseeder

Figure 3.5.9 Trailer Type Hydroseeder

Photograph Courtesy of Bowie Hydroseeder

Table 3.5.1 Characteristics of Various Spreading Equipment*

Type	Advantages	Disadvantages
Hand-held Spinner Type Spreader	° Inexpensive ° Simple to use & repair ° Can apply both fertilizer & seed ° No special training needed	° Slow ° High labor use ° Skip & overlap possible ° Seed may need to be incorporated into the soil following application
Mechanical Spinner Type Spreaders	° Fast ° Can apply both seed & fertilizer ° Relative low cost equipment	° Skip & overlap possible ° Seed may need to be incorporated into the soil following application
Drop Type Spreaders	° Fast ° Simple ° Can be used to apply both fertilizer & seed	° Skip & overlap a serious problem if care is not taken ° Hard to calibrate ° Equipment needs high degree of care
Drill Type Seeders**	° Seed incorporation not needed as a separate step ° Precise application ° Skip not a problem ° Uses only half the seed	° Does not apply fertilizer ° Equipment more costly ° Needs higher degree of seedbed preparations
Hydroseeders	° Degree of slope not a problem ° Skips not a problem ° Can apply both seed & fertilizer	° Equipment costly ° Needs water source ° Complex equipment

* The type of machinery used to apply seed and fertilizer should be the choice of the contractor. It is often based on local availability. The method should be noted in the bid response so accurate comparison can be made by the contracting officer.

** Note: If drill seeders are employed, only use 1/2 the recommended seeding rates.

3.6 Mulch & Erosion Matting

Mulches and erosion matting are only appropriate or necessary if erosion potential is significant. Erosive forces can be either wind or water. However, when hydroseeders are used, mulch is standard. The mulch fiber forms a slurry that acts as a carrier for the seed and fertilizer. Without the mulch, seed and fertilizer would not suspend in solution and uniform distribution would be impossible. The mulch also marks the area that has been sprayed.

When deciding on the use of a mulch such as straw or an erosion matting, several factors should be considered; erosion potential is the first consideration. If the soil does not have a high erosion potential, then mulch and/or matting should be skipped. The second consideration is cost. Application of mulch and matting add significant costs to a project, not only in materials, but also in labor. The third consideration is safety. The concern with netting is the potential of sections coming loose and causing hazards to aircraft. A final concern is that straw may introduce unwanted noxious weeds.

The above concerns do not apply to wood fiber or similar products used in hydroseeders.

Table 3.6.1. Mulch & Netting Comparison Chart

Mulch/ Netting	Difficulty In Use	Erosion Resistance	Cost	Cost to Apply	Environment Restrictions in Use	Most Effective on Soil Type
Wood Fiber	N	Low	Low	Low	Few	All
Straw	N	Medium	Low	Moderate	High Winds Hamper Use	Fine Grain
Jute Mesh	Y	Medium	Moderate	High	None	Course Grain
Tack Netting	Y	Low	Moderate	High	None	Course Grain
Excelcior	Y	High	High	High	None	All
Chemical Stabilizer	N	Varies	Varies	Low	Temperature Requirement	Course Grain

3.7 Transplanting and Sprigging (Advanced Techniques)

Of all revegetation techniques, the use of living plants or parts of living plants is the most labor intensive. However, there are times when the most appropriate revegetation method is planting transplants or sprigs (cuttings).

The most common and longest used method of vegetative plantings in Alaska is the use of willow cuttings. Another more recent method of transplanting was developed and proven effective on the Aleutians under various Department of Defense contracts and studies. This technique relies on planting sprigs of Beach wildrye (*Elymus mollis*) (*Leymus mollis*).

Revegetation techniques with vegetative material require a great deal of planning and should not be attempted without consulting with experienced persons. Transplanting whole plants is not covered in this report.

3.7.1 Willow and Other Woody Cuttings

The use of willow cuttings has been proven successful throughout areas of Alaska where willow occur naturally. Timing is critical to both collection and planting. Prior planning is an absolute necessity. For directions, please refer to the manual in Appendix E.

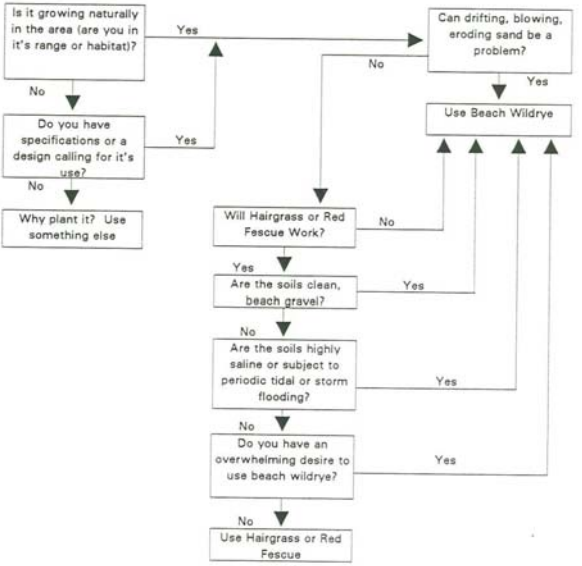
3.7.2 Beach Wildrye Sprigging

This technique was initially developed and proven effective on Shemya Island. The species can be used anywhere in coastal and insular Alaska, however, dune areas adjacent to shorelines are ideal. Sand is the ideal medium for planting, but gravels and rocky soil will also support the species. All text, figures and tables used in Sections 3.7.1 to 3.7.2.12 are derived from a state document in press and should be foot noted accordingly if used or reproduced. See Appendix F; Wright *in Press*. Following publication of Beach Wildrye Planting Guide for Alaska, this section will be dropped and Appendix G will be added containing the "Guide".

3.7.2.1 THE FIRST DECISION: DO YOU NEED BEACH WILDRYE?

If you wish to revegetate or control erosion on a coastal or foredune area where drifting sand is a concern, Beach wildrye may be the only solution. If an existing stand of Beach wildrye needs to be recreated, it is the only solution.

Table 3.7.1 Do I need or want Beach Wildrye?



3.7.2.2 WHAT TO PLANT: THE SECOND DECISION

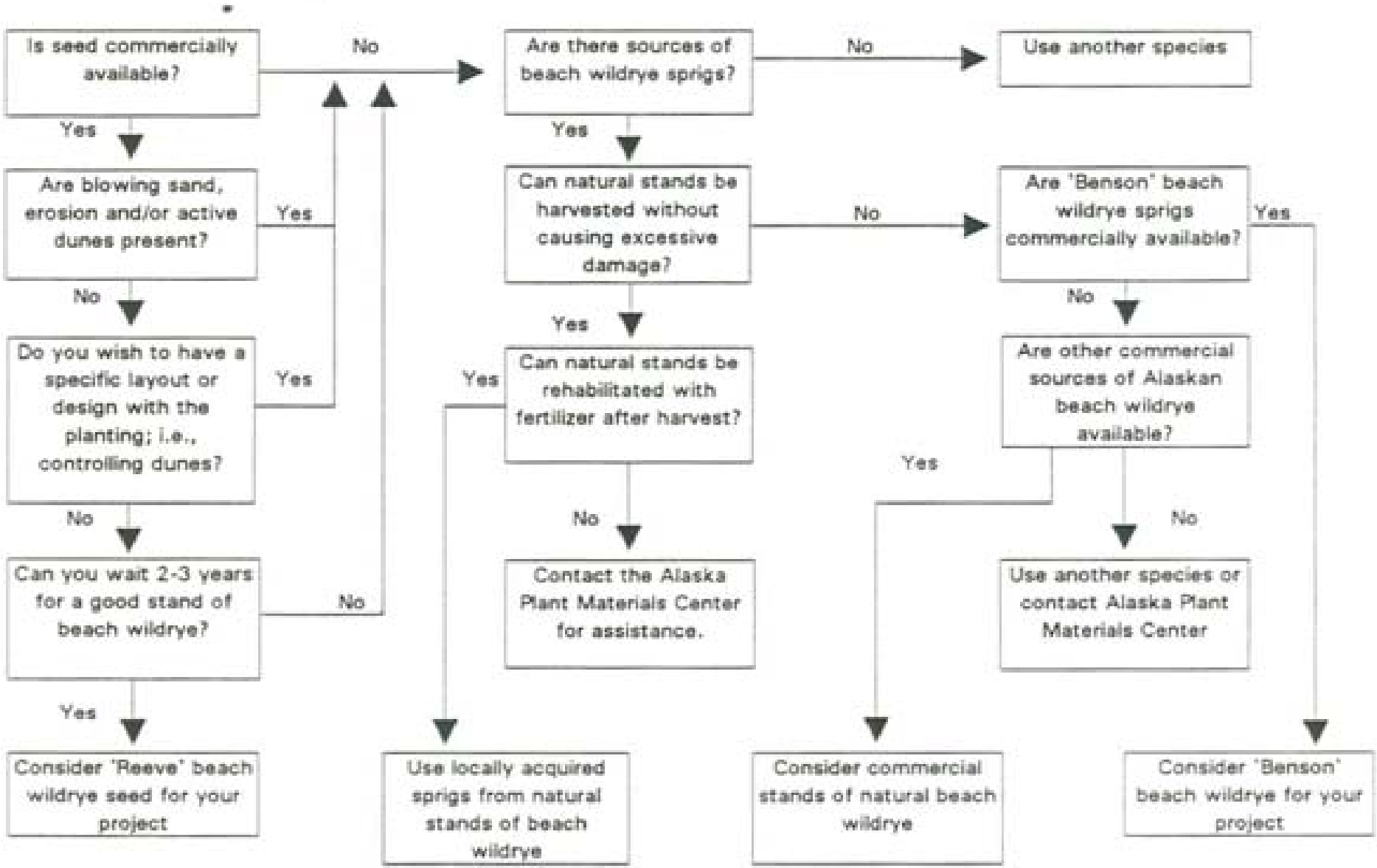
Usually when planning a revegetation or erosion control project, seed is used. However, Beach wildrye may require a different technique. At the time of this publication's printing, Beach wildrye seed is not commercially available. In 1991, two cultivars of Beach wildrye were released for commercial production. One was developed for vegetative reproduction (or sprigging), the other for seed production.

To date, the most common method of planting Beach wildrye has been sprigging. As seed becomes commercially available, more projects will use standard seeding methods.

SEED VS SPRIGS	
Advantages	Advantages
Reduced Cost Low manpower requirements Standard method	Readily available Can be used on erosive sites High degree of success Allows for layout design Can tolerate flooding by high tides or storm surges
Disadvantages	Disadvantages
Slow growth Low vigor Short supply Not adapted for all sites	Higher manpower requirement Costs increase

If seeding is selected, use standard seeding procedures. Sprigging is described in this section.

Table 3.7.3 Beach Wildrye Procedure Selection Chart



3.7.2.3 Timing

The transplanting can start as soon as the soil is thawed and can be worked. It is best to complete the transplanting prior to July 15. However, plantings made in September have survived on the Aleutian Islands.

3.7.2.4 Harvesting Transplants

The transplants (sprigs) can be dug by hand or with standard construction equipment. A loader or backhoe will expedite the operation.

If hand shovels are used, the procedure is self-explanatory. However, construction equipment simplifies the task. As shown in Figure 3.7.1, the loader simply scoops out a patch of Beach wildrye about two feet below grade.

Figure 3.7.1 Harvest of Beach Wildrye.

The bucket load of soil and plants is then lifted out of place and dumped (Figure 3.7.2). The movement of the material allows the Beach wildrye sprigs to be easily pulled out by hand as shown in Figure 3.7.3.

Figure 3.7.2 Beach Wildrye Being Separated Through Movement.

Figure 3.7.3 Beach Wildrye Being Sorted Prior to Bagging.

A typical sprig will look like the specimen in Figure 3.7.4. The long root shown in Figure 3.7.4 need not be present. The portion of the plant right of the hand drawn line is the critical part. However, the root need not be removed, nor does the plant need to be green at planting.

Figure 3.7.4 Typical Beach Wildrye Sprig.

Figure 3.7.5 Shows a Sprig that can be Further Divided into Three Sprigs.

After a mass of sprigs is harvested (Figure 3.7.6), they should be bagged (Figure 3.7.7) for transport to the planting site. The bagging will prevent the sprigs from drying out. Only dig as many sprigs as can be planted in one day.

Figure 3.7.6 Mass of Beach Wildrye Sprigs.

Figure 3.7.7 Bagging Sprigs for Transport.

3.7.2.5 PLANTING

Planting can be done with shovels or construction equipment. If a shovel or spade is used, simply drive the point four to six inches in the soil. Push the handle forward and slip the sprig into the slit behind the shovel. Note this is done without withdrawing the shovel or spade.

It is more efficient to use machinery to open trenches as shown in Figure 3.7.8.

After the area is planted, fertilize the site with 20-20-10 fertilizer at a rate of 800 pounds per acre.

If the sprigs are green during planting, do not become concerned if they turn brown. The sprigs will initiate new growth from the below-ground portion. By late summer, the area should be green and look like the surrounding tundra.

Figure 3.7.8 Trenches Cut for Sprig Planting.

Any piece of equipment that can cut a trench three to four inches deep can be used. On Shemya AFB, a dozer blade was modified (Figure 3.7.9) with "tiger teeth". The trenches shown in Figure 3.7.8 were made by back-blading on float.

Also, the distance between rows and sprigs was 18 inches. In areas less erosive, 36 to 48 inches between rows is satisfactory.

Figure 3.7.9 "Tiger Teeth" on Dozer Blade.

The actual planting technique is referred to as a drop, kick and stomp method. This technique has not been described in any landscape or horticulture text; however, this technique worked well at both Shemya AFB and Adak NAS. See Photos 3.7.2.10 - 3.7.2.12.

3.7.2.10 Drop. Simply drop sprig into hole or trench; it need not be upright.

Figure 3.7.2.11 Kick. Without a great deal of care, simply kick soil over the sprig.

Figure 3.7.2.12 Stomp. The final step involves stepping on the soil and sprig in order to assure good soil/sprig contact.

3.8 Natural Revegetation (Do Nothing)

Natural revegetation relies on the tendency of vegetation to move into a disturbed area. Most disturbances, whether natural or man-made, will eventually be recolonized by plants. The conditions that determine the length of time needed to produce a cover of vegetation depends upon several factors, including proximity of viable seed sources, surface conditions of the disturbed area, and local environmental conditions.

In time vegetation will return. Problems arise when natural revegetation does not occur rapidly enough to prevent erosion, sedimentation and improve the appearance of the site. Natural revegetation is a valid approach and should be employed when conditions and politics allow.

REVEGETATION SPECIFICATIONS

FOR KING SALMON

AIR FORCE BASE

SECTION 4

4.0 KING SALMON AIR FORCE BASE

4.1 Introduction

King Salmon Air Force Base is located primarily on an upland site approximately 15 miles from the mouth of the Naknek River. The King Salmon Creek flows on the west side of the base; Eskimo Creek flows through the center; the town of King Salmon is located to the south and open relatively undisturbed land occurs to the north and east of the Base. Disturbed sites requiring revegetation have been identified on the Installation Recovered Project (IRP) site map prepared by the Air Force.

4.2 Vegetation Types

Four basic vegetation types which will require revegetation comprise the land managed by the King Salmon Air Force Base. The revegetation plan will vary slightly for each of these vegetation types.

4.2.1 Upland Vegetation

Most of the upland revegetation sites not highlighted on Figure 4.2.1, are characterized by compact soils with a gravel surface. Other sites are much more sandy. Little to no natural revegetation has occurred at these sites probably because the soil has been excessively compacted and human activity has continued. Some of the sites will require building demolition and removal of stored materials prior to site restoration. All of the sites will require scarification prior to seeding (Figures 4.2.2, 4.2.3, and 4.2.4). Most sites are smaller than five acres and are level. Broadcast seeding would be the most efficient planting method (refer to earlier section of the document). If several sites are ready for seeding at one time, then a hyroseeder could be used . Seed and fertilizer sound in Treatment A should be applied to these upland sites. The sandy, silty sites (Figure 4.2.4) could be sprigged with beach wildrye (refer to Section 3.7.2) or 'Reeve' beach wildrye seed could be included in the mix listed in Treatment A when it becomes available.

4.2.2 Upland Vegetation - Landscaping for Parks, Playing Fields, etc.

One site, a former landfill (Figure 4.2.1, red highlight) has already been turned into a Borough Park (Figure 4.1.5). Other sites slated for revegetation may also be suited for additional park land, or ball fields. Areas that are designated for public use should be revegetated with the seed and fertilizer Treatment B.

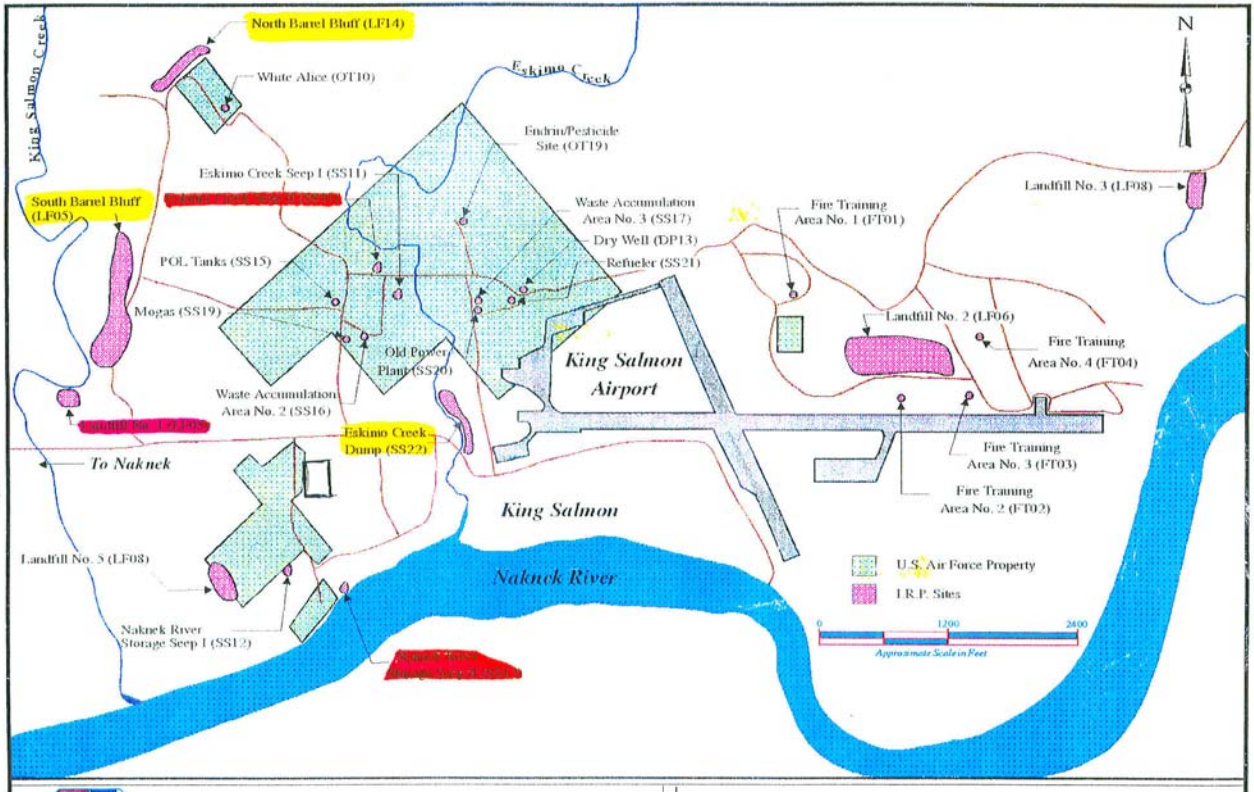


Figure 4.2.1

IRP Sites
King Salmon Airport
King Salmon, Alaska

Figure 4.2.2 White Alice Station.

Figure 4.2.3 Landfill 2.

Figure 4.2.4 Barrel Recovery and Environmental Cleanup - IRP; a sandy site.

Figure 4.2.5 Landfill #1 - Borough Park.

4.2.3 Bluff Vegetation

The three bluff sites (yellow highlight, Figure 4.2.1) have revegetated naturally with several native species including bluejoint reedgrass, hairgrass, fireweed, goldenrod and willow (Figures 4.2.6 and 4.2.7). These sites still contain large quantities of buried barrels which will be removed prior to final restoration. Since these areas will be disturbed the top layer of soil should be stockpiled when work is initiated and respread over the top surface when work is completed. The buried seed bank in the stockpiled soil will assist the revegetation process and provide an opportunity for a greater diversity of species to revegetate the site. After the planting surface has been scarified, seed and fertilizer described in Treatment A should be applied. Truck and 4-wheeler traffic on the level areas above the bluffs appears to prevent plants from becoming established. These areas may not be worth reseeding unless vehicle traffic can be restricted.

4.2.4 Riparian - Wetland Vegetation

Two sites are most likely to be described by these vegetation types, Eskimo Creek Seep II and Naknek River Storage Seep II (Figure 4.2.1, orange highlight). Figures 4.2.8 and 4.2.9 show two views of the Naknek River Storage Seep II. The final condition of the site will determine if Treatment C is the most suitable revegetation approach for the site. If the site, or portions of the site contain moist or saturated soils, then Treatment C should be used. If the site no longer contains moist or saturated soils, then Treatment A should be used.

Figure 4.2.6 North Barrel Bluff - Willows, Fireweed and Bluejoint Reedgrass have Colonized the Slope.

Figure 4.2.7 South Barrel Bluff - Bluejoint Reedgrass and Fireweed have Colonized the Slope. Truck and 4-Wheeler Traffic Appear to Prevent Plants from Growing on the Level Areas.

Figure 4.2.8 Close up of Naknek River Storage Seep II.

Figure 4.2.9 Naknek River Storage Seep II.

4.3 Revegetation Treatments

The treatments outlined in this document were developed because two different moisture regimes were likely to be encountered during the revegetation process and different land uses may be planned for the sites. Treatments A and C provide dry and wet land revegetation plans respectively; were designed to stabilize the sites from wind erosion and encourage the development of native plant communities on the sites. Treatment B was designed to provide a hardy ground cover suitable for public use of an area.

4.3.1 Seed and Fertilizer Treatment A

These seed mixes are designed for areas that are well drained, gravelly and sandy, upland sites.

Seed Mix Species List	Percent by Weight	Sandy Sites Percent by Weight
Norcoast Bering Hairgrass	75	75
Arctared Red Fescue	20	-
Caiggluk Tilesy Sagebrush	5	5
Reeve Beach Wildrye (if available)		20

Seeding Rate: 40 pounds per acre - upland sites
25 pounds per acre - bluff sites if topsoil is salvaged

Fertilizer Rate: 500 pounds per acre of 20-20-10

In lieu of seed Beach wildrye, sprigging these sandy sites is also an alternative (Section 3.7.2). If fireweed, goldenrod and lupine become available in the near future, they would make good additions to the seed mix.

4.3.2 Seed and Fertilizer Treatment B

This seed mix is designed specifically for public use areas where considerable foot traffic is likely to occur.

Seed Mix Species List	Percent by Weight
Arctared Red Fescue	30
Boreal Red Fescue	20
Nugget Kentucky Bluegrass	30
Merion Kentucky Bluegrass	20

Seeding Rate: 60 pounds per acre
Fertilizer Rate: 500 pounds per acre

Public use areas should be maintained with an annual application of 10-20-20 fertilizer at a rate of 250 pounds per acre. Fertilizer should be applied from mid June until late July.

4.3.3 Seed and Fertilizer Treatment C

This revegetation treatment is designed for areas containing moist to saturated soils. The species in this mix also tolerate standing water for portions of the growing season.

Seeding with this mix should occur during periods of relative dryness. If at all possible, the seed should be incorporated into the soil, particularly at the Naknek Storage Seep II site.

Seed Mix Species List	Percent by Weight
Norcoast Bering Hairgrass	60
Egan American Sloughgrass	25
Kenai Polargrass	15

Seeding Rate: 40 pounds per acre
Fertilizer Rate: 400 pounds per acre

If water sedge, beach lovage and bluejoint reedgrass become available in the near future, they would make good additions to the seed mix.

The Naknek Storage Seep II site presents special challenges for seeding. The area is affected by daily tide and seed can be easily washed away. Planting sprigs and transplants is more appropriate for revegetating these types of conditions. Sprigging with water sedge (*Carex aquatilis*) is appropriate for the area along the water's edge. Sprigging techniques are described in the section on beach wildrye (3.7.2). Transplants of seedling grasses listed in the seed mix would also be a suitable revegetation technique for this tidally influenced area.