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VEGETATION REMOVAL AND RESTORATION/ RECLAMATION

Guidelines

Banff National Park

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SCOPE OF APPLICATION

These guidelines are meant to be used to help understand how restoration and reclamation should be addressed in Banff National Park. Restoration and reclamation are dynamic processes that require site-specific considerations, as such these guidelines provide options for projects and are not prescriptive in nature. Vegetation specialists must be included early in projects that disturb vegetation in order to establish which restoration activities will be most appropriate and effective.

Project activities that may alter or remove vegetation include mowing, brushing, and landscape maintenance activities, non-native species management, fuel reduction and pre-construction site clearing.

To successfully complete restoration and protect disturbed areas from erosion, proper vegetation and soil management procedures must be followed.

SARA AND OTHER CONSIDERATIONS

VEGETATION

- Whitebark pine (*Pinus albicaulis*) is a SARA (Species at Risk Act) listed Category I species. Removal or destruction of critical habitat requires SARA authorization in accordance with the Species at Risk Act
- Limber pine (*Pinus flexilis*) is a COSEWIC and provincially (AB/BC) listed endangered species. For the purpose of this document, Limber pine should be dealt with in the same manner as Whitebark pine.
- Mature, large diameter Douglas-fir and Rocky Mountain Juniper removal requires approval from the Fire and Vegetation Management Section as they are considered special resources in Banff National Park
- Fescue grasslands are sensitive features and work in or adjacent to them requires consultation with vegetation specialists.

WILDLIFE AND AMPHIBIANS

- The regional migratory bird nesting periods can be found on the Environment Canada website. Vegetation removal within the migratory bird nesting window will be avoided. If vegetation removal is scheduled to occur within this period, national direction will be followed.
- Similarly, any vegetation removal that will impact SARA listed wildlife species will be done in accordance to existing authorisation processes and appropriate mitigations for that species.
- If vegetation removal is to occur adjacent to a confirmed or potential amphibian breeding wetland, an aquatics specialist should be consulted and site-specific mitigations developed.

PLANNING CONSIDERATIONS

1. How can disturbance (area and time) be minimized or avoided?
2. Is vegetation removal required, or will existing cleared area be used?
3. Where will stripped soil/sod/vegetative materials be stored and/or disposed?
 - a. Will there be a requirement for local or non-local import of soils post-disturbance?
 - b. Will vegetative or woody debris require disposal? If so, refer to BFU/LLYK Woody/Vegetative Debris Management Guidelines (Parks Canada, 2017)
4. How is erosion and sedimentation being controlled?
5. What is the re-vegetation plan?
 - a. Where are the seed/stakes/plugs/plants/trees being sourced?
 - b. Will they be available for planting immediately post-disturbance?
6. Are there non-native/invasive vegetation issues at the site?
 - a. Do they require pre-construction mitigation?
 - b. How will they be monitored/controlled post-construction?

RESTORATION PLAN

- A restoration plan that details post-construction restoration or reclamation activities must be completed prior to construction. This information can be included in the Environmental Protection Plan (EPP).
- Each section of this document should be addressed in the restoration plan (vegetation removal, soil disturbance, excess Materials, construction mitigations, re-vegetation, monitoring and control) when planning restoration work.
- Achievable restoration goals with appropriate timelines should be determined prior to disturbance and be included in the Restoration Plan.
- For projects of vast geographic scope, requiring significant reclamation, or landscape level vegetation restoration projects may require the use of restoration specialists/contractors to develop a detailed restoration plan.

VEGETATION REMOVAL

MECHANICAL REMOVAL

If a project includes mechanical removal of vegetation, a written plan must be submitted to the ESO/Fire and Vegetation section. Once the plan has been approved, the contractor must contact the ESO at least 5 days prior to commencement of tree/vegetation removal.

CONSIDERATIONS

- Prior to any mechanical vegetation removal, all appropriate specialists should be consulted with regards to, but not limited to, bird nesting (cavity nesting, migratory birds), amphibian habitat, sensitive and rare plants, wetlands/mesic sites, SARA etc. The BIA/EPP for the project should specify particular impacts and appropriate mitigations.
- Maximize vegetation retention when possible to reduce erosion. Vegetation removal should be limited to the minimum area required for safe operations during construction or to meet the objectives of the clearing activities (i.e., fire breaks, sight lines etc.). In the case of excavation, sod stripping must occur, see *Sod stripping and salvage* section below.
- Typically vegetation removal will not occur closer than 30 meter around aquatic features, but site specific requirements will be determined by the Aquatics specialist.
- Debris management should follow established guidelines in consultation with the field unit fire and vegetation section.

NON-NATIVE VEGETATION

- Field unit vegetation specialists will recommend the appropriate approach to mitigate the establishment/spread of NNV (non-native vegetation) on the site. Mitigations may include the following:
 - Washing of all machinery to get rid of any residual soil and/or seeds prior to entry into the park.
 - Pre-construction treatment of site or equipment through mechanical or chemical control and/or matting
 - Pre-construction vegetation collection for post construction planting/seeding
 - Post-construction monitoring and control of NNV

CLEARING

- Vegetation clearing should be conducted using methods that minimise ground disturbance, promote effective reclamation and minimise the potential for the establishment and spread of non-native vegetation.
- In areas where the disturbed area will not be reclaimed (e.g. paving projects, building development etc) clearing methods may be prioritised to increase project efficiency

- Mulching of vegetation will only be used in specific situation where the quantity of vegetation to be removed will not impeded restoration of native vegetation. When mulching is the proposed method of vegetation clearing, disposal of the debris will be determined based on restoration objectives, non-native vegetation, and fire hazard mitigations.
- If mulching is used to clear vegetation, rough mulching is the preferred option.
- For forest/tree clearing activities, whole tree harvesting techniques are preferred to expedite reclamation and native plant establishment on site. Processing trees at the stump will only be considered with an adequate reclamation and debris management plan.
- For large scale forest clearing operations, merchantable timber should be surveyed to ensure that any revenues are returned to the crown.
- The Visitor Experience Manager for the field unit will be consulted as to whether any wood can be salvaged and transported for use as firewood in campgrounds.
- All provincial policies with regards to the transport of wood inter-provincially will be adhered to (i.e. requirements to transporting of harvested trees with respect to forest insects and disease)
- Damage to non-target trees must be avoided. ESOs will monitor sites to ensure that delayed mortality of remaining trees is minimized.
- Any high value wildlife trees (i.e. those w/ active nests or cavities) should be considered for retention.
- All stumps should be cut flush with the ground (to a maximum of 15 cm), and the ground cover left undisturbed to promote slope stability. If clearing operations are conducted during snow cover, the site must be revisited after snowmelt to flush cut stumps. Flush cutting stumps to a maximum of 5 cm height.

GRUBBING

- Grubbing should only be conducted if the project requires the removal of stumps, if not required to meet project objectives, the vegetation specialist may recommend that stumps be left in place in order to reduce soil disturbance and exposure.
- Grubbing and stripping operations must ensure that the trees and roots on the edge of the clearing limits are not disturbed or damaged.
- On steep slopes, grubbing and stripping may not be permitted.

EQUIPMENT FOR VEGETATION REMOVING/GRUBBING

- If large scale timber removal is required, rubber tired/low pressure feller buncher/skidder operations are recommended to reduce the need for extensive post-harvest debris management and required rehabilitation (skid trails and landings are easier to restore/reclaim than entire project sites).
- All machinery must be cleaned prior to entry into the park.
- If a harvester-forwarder system is used, minimum amounts of coarse woody debris is allowed to be left on site. See BFU/LLYK Woody Debris Management Guidelines
- Limbing must be completed using the appropriate equipment to minimize damage to the tree (i.e., using a hoe bucket to limb trees is not appropriate as it can cause the bark to tear and can make the remaining tree vulnerable to diseases and rot).

SOD SALVAGE AND STORAGE

- Sod stripping should be completed in all areas where mats of grass exist to assist with effective restoration. This can be accomplished by using a sod stripping machine or by hand on smaller areas.
- Strip ground cover vegetation, including grass, perennials, and woody ground covers, including the root layer immediately above the topsoil layer, in areas where ground disturbance is required.
- Clearly mark areas for sod salvage to avoid additional disturbance.
- Sod should be comprised of 50% or more vascular plant species and established root structures before vegetation sod salvage and transplantation should be attempted.

- Remove sod in square cornered blocks, hand cut by shovel or with clean-up bucket of excavator, on a level plane below the root, and maintain a consistent depth of 10 to 15cm.
- Use hand crews to assist the excavator to remove sod blocks with cutting and storage of sod. Gather loose soil and root material to be retained with sod.
- Do not bend or roll sod blocks and minimize the amount of handling.
- Store sod on flat ground or pallets or wood sheeting.
- Sod must be stored with grass blades facing upwards (e.g. not facing the ground). Sod mats may be stored in a pile, provided that each layer is placed with grass blades facing upwards.
- Cover salvaged sod with a white, breathable geo-textile fabric to protect from precipitation and sun and stack sod blocks.
- Removal of sod by hand in the alpine is preferred, to better protect sensitive plant communities and to maximize reclamation success in alpine areas.
- Keep stockpile moist in dry weather without over-watering, wet sod may compost.
- Place salvaged sod in low profile (<60cm in height) windrows with the appropriate erosion control for rain and windy conditions, in a weed free area for storage designated by the Vegetation specialist/ESO.
- Re-plant sod as soon as possible.

SOIL DISTURBANCE

SOIL CONSERVATION

- Vegetation removal using heavy equipment should only be conducted when the ground is frozen and/or snow covered. Any work conducted outside of these periods should identify adequate mitigation measures (e.g. rig matting, low pressure equipment etc) to avoid additional ground disturbance.
- Mechanical work should avoid periods of wet weather and saturated soils. If work is required during these periods, adequate mitigations to prevent excessive rutting, erosion and sedimentation must be in place and approved by the ESO/vegetation specialist.
- Salvage topsoil and subsoil at all excavation sites for restoration purposes, refer to Excess Materials section if there is a surplus of soils
- Prevent loss of topsoil through wind or water erosion by staging in an appropriate covered area and covering (see specifications below). This allows for the process of solarization (see specifications below) to help control weed seed bank.
- If stripping soil close to any watercourse, water body or wetland employ methods to ensure materials are not pushed, do not fall or erode into the water or wetlands. Consult with an aquatics specialist to ensure appropriate sedimentation mitigations are in place.
- Strip topsoil under dry conditions, whenever possible.
- In the event of a work program shutdown during inclement weather (e.g. winter conditions unfavorable for construction, heavy rain events, construction delays, etc.) contingency planning for bared soils or excavated material stockpiles is required, and may including the following:
 - Covering stored soil with a dark plastic tarp to aid in non-native vegetation control through solarization of soil
 - Treating the soil for non-native vegetation

SPECIFICATIONS

- No stripping shall occur outside of the delineated work area or within 1 meter of the drip line of existing forest.
- Stripping must occur in two lifts if possible and if being stored on site, separated by at least 1 meter and covered (see below). Sensitive sites may require a three lift procedure.
 - Lift 1 (topsoil, O and A horizons): in Banff National Park topsoil is typically a very thin layer of organics and soil
 - Lift 2 (sub soil, B and possibly C horizons): this is referred to as the “mineral soils”

- Typically there is a distinct color change between the topsoil and subsoil. Ensure conditions are dry in order to see the distinct color differences.
- Minimize soil movement and handling to protect existing native seed bank.
- Material encountered below the topsoil layer, which is not suitable for construction purposes may be disposed of at designated locations, in consultation with ESOs and Field Unit Asset Managers.
- All excavations must be approved by the ESO in consultation with the Field Unit Cultural Resource Manager with respect to archaeological resources.

SOIL STORAGE

- Soils storage locations need to be considered while developing construction plans. During the winter (when ground is frozen) soil storage can occur on undisturbed areas. When soil is thawed it should be staged on previously disturbed areas (pull outs, roads, trails, campsite, and staging area) so that no soil compaction occurs outside of construction area.
- To avoid soil loss, soil should be stored in areas not prone to high winds.
- Excavated soils need to be covered to ensure that weeds are not able to establish on the disturbed soils. Even if weeds were present on the site a cover is required in order to decrease weed seed via solarization (baking).
- Allow space for separate storage of topsoil and spoil; where space is available, separate stored topsoil from other soils by at least 1 m. Use appropriate material (e.g., geotextile) to separate soil components where space is limited.
- Topsoil from separate ecotypes, different areas of the project or different projects cannot be mixed without approval of the ESO through consultation with the vegetation specialist (i.e., grassland soils must be kept separate from forested soils).

SPECIFICATIONS

STOCKPILES

- The location of soil stockpiles will be designated by the ESO in consultation with the vegetation specialist and Field Unit Asset management section
- Topsoil should be stockpiled on the uphill side of the disturbance on sloped terrain and away from any grades, subsoil's, spoil material, construction activity and day to day operations. Surrounding soil with berms to avoid material loss
- Construct barricades in areas with slopes greater than 18° to prevent losses.
- Locate stockpiles on flat ground away from drainage and water bodies (min. 30m), and work/equipment areas
- Stockpile should not exceed heights greater than 2 m
- Stockpiles may require erosion control, sedimentation protection or stabilization, depending on the location and anticipated duration of storage. At the ESO discretion, the Contractor shall prepare a plan for management of each stockpile.
- Leave stockpiled topsoil in rough condition (i.e, do not compact and/or smooth).
- The ESO may designate separate storage of topsoil zones whereby forest soils are stored separately from grassland soils and weed contaminated soils are separated from clean topsoil.

STOCKPILE COVERINGS

- Dark plastic or geotextile is ideal, if not available clear plastic is acceptable for short term (1 season)
- Cover needs to be anchored into or firmly set over pile
- All edges should be held down firmly by wooden debris, construction materials, subsoil (if soil storage location is on stripped area) so that wind does not cause the cover to blow off

LONG TERM STORAGE (>30DAYS)

- During long term storage, native seed (approved by Fire and Veg) can be planted over stockpiles instead of using covers if approved by the ESO. Typically, if site does not have a non-native vegetation issue, seeding is preferable as it maximises soil conservation and covers degrade and can be blown off/removed after weathering.

CONTAMINATED SOILS

- Contaminated soils will be addressed via the EA Process and may involve Federal Contaminated Site specialists.
- Generally, the minimum acceptable remediation/reclamation standard in Banff National Park is a CCME "Parkland" criteria.
- If soil disposal is required, proper manifesting and landfill criteria will be required. The closest Class 3 landfill is Francis Cooke Landfill in Exshaw, contact number is 403-673-2708

EXCESS MATERIALS

- Occasionally, a project will result in more material than can be used. If so, this material must be moved off the project site and arrangements must be made for disposal or stockpiling for other projects in consultation with the ESO and vegetation specialist.
- Surplus excavated material may be used to fill depressions around the project site provided that topsoil is stripped before filling, with approval from ESO in consultation with Assets/Highway SC.
- Excess materials should be stored in piles separated by horizon (i.e. topsoil stored separately from subsoil).

RE-VEGETATION

SUBSOIL REPLACEMENT

- Backfilling should be allowed to settle to prevent depressions however, long term roach piles on linear disturbances should be minimal.

TOPSOIL REPLACEMENT

- Soil import from other project sites or outside of the Park is not recommended. Through proper soil management it should not be required, however in the circumstances that top and subsoil import are required please refer Appendix B: Soil Import which outline testing requirements for soil import (at the cost to the proponent).
- An Erosion and Sediment Control Plan (ESCP) must be implemented, monitored and adapted to ensure soil erosion due to wind and water are mitigated.
- Replace topsoil in all areas immediately following fine grading of subsoil
- Do not compact topsoil by driving repeatedly over site. Keep topsoil "rough and loose".
- Where remaining soils are unstable due to steepness or soil characteristics, immediate installation of sod or other erosion control is required.
- Methods of bioengineering such as terracing, willow staking, live pole drain systems should be assessed as solutions where soils are steeper or remain unstable.
- Any use of compost, foreign soils, fertilizers and soil amendments must be approved by the ESO in consultation with the vegetation specialist.
- For three lift procedures, the final layer of organics should be placed last.
- Topsoil shall be reapplied at a depth no less than 50 mm or as at a depth of the original site conditions. Topsoil depths can be increased on gentler slopes (<3H:1V) and the surface should remain rough.
- Manufactured topsoil products may be considered in consultation with the ESO and vegetation specialist

SURFACE PREPARATION

- Implement restoration plan for the disturbed area immediately following completion of construction. Long delays between vegetation removal and re-vegetation should be avoided to mitigate the establishment and spread of

non-native vegetation. For projects with a vast geographic area, re-vegetation in smaller phases should be considered to minimise soil exposure.

- Timing of placement and grading of topsoil should coincide with re-vegetation/seeding without winter intervening.
- Grading or topsoil placement shall be completed to the satisfaction of the ESO prior to any surface preparation.
- All eroded areas shall be corrected prior to surface preparation, as determined by the ESO, using local material where possible.
- Areas to be seeded shall be loosened to a depth no less than 200 mm (greater where site conditions warrant) at the time of seeding so allow seed to be planted at a depth of 25mm-75mm.
- Final seedbed “rough and loose”, it shall be rough and undulating.

SEED/PLANT SELECTION

- The vegetation specialist will be consulted to determine the appropriate seed mix and plantings for the Project.
- The percentage of individual species within mixes are approximate and may vary depending on seed availability. A number of native species that are available only in limited quantities commercially have been included in the seed mixes. These seed mixes are to be used conditional on availability of individual species; modifications/replacements are allowed, subject to approval.
- Native species with low palatability to wildlife are preferred for projects in areas of high human use
- Low flammability vegetation is recommended for any areas adjacent to facilities or infrastructure.
- Ensure all imported vegetation (seeds, sod or other plantings) do not transport non-native vegetation, noxious or restricted weeds. The proponent will be responsible for eradicating infestations at the direction of Parks Canada.
- Seed coating (including “ultra coating”) is prohibited without prior approval.
- Prior to seed purchase, certificates of seed analysis will be provided to the vegetation specialist for approval.
- No seed will be purchased until written approval is obtained
- Certificates of Analysis must include both the common and include the scientific name following the CANADENSYS nomenclature system; indicate if the seed is a cultivar, ecovar, or wild native; geographic origin (seed source); date of collection; method of seed storage; germination, viability and vigour; and indicate all other species occurring including agronomic, weed, and native species; and date of the analysis. The contact information for the Seed Supplier will be included.
- All seed is subject to testing by PCA prior to use.

SEEDING

TIMING

- Seed areas of the project immediately once they are brought to final contour, a project phase is completed, or if soils will be left dormant for >30 days.
- On large projects, incrementally seed area as soils are prepared. Do not delay seeding until all areas of the project are brought under final contour.
- Construction should be scheduled so that seeding can coincide with seasonal planting windows (i.e., periods of time when seeding is most likely to result in successful plant germination and growth); below are rough timelines but seasonal variability must be accounted for.
- Spring: April-June: No snow cover; ensure machinery does not compact/rut soils.
- Summer: July-September: Do not seed; conditions nor suitable for germination.
- Fall: Late September- early November: Until snow cover/ground freezes.
- Supplemental seeding may be required in subsequent years

CONSIDERATIONS

- Apply seed at a rate appropriate to the seed mixture, seeding method and existing vegetation conditions as directed by the vegetation specialist.

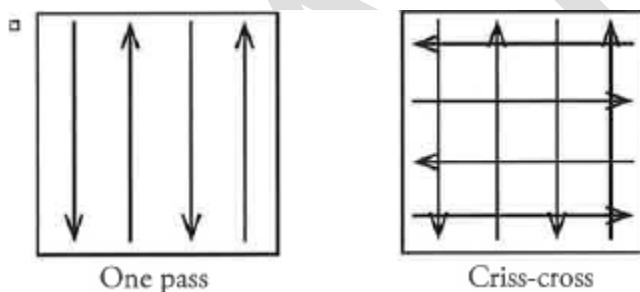
- Seeding shall not take place when wind conditions are such that material is being carried beyond the designated work areas or that the material is not being uniformly applied.
- Hydro-seeding only acceptable in large areas and steep slopes as approved by vegetation specialist.
- Seeding is not permitted on hardened (compacted), crusted or mechanically rutted surfaces.
- Protect seeded area against erosion or damage as appropriate for the specific site (i.e, erosion control blanket, hydro-mulching, mulching)

SPECIFICATION

- Standard seeding rate is 25kg/ha and may be adjusted as dictated by site conditions.
- See appendix A: Seeding, Mulching and Erosion Control Specifications

APPLICATION

- Broadcast seeding should be completed in two passes. The second pass should be 90degrees to the first pass to ensure seed is applied to all soil surfaces. Objects on the soil can create “shadows” preventing seed placement in these areas, the second pass fills in the “shadows”. Application rate per pass should be $\frac{1}{2}$ of the total application rate. Seed should be planted 25mm-75mm below surface; soil should be raked or rolled after seeding to set seed in place (and reduce foraging of seed). If required, mulch should be applied after broadcast seeding (no need to rake/roll), see mulching
- Example:
- Monitor temporary erosion control measures to prevent seed loss.



MULCH TO ASSIST WITH SEED ESTABLISHMENT

In cases where mulching has been deemed appropriate to assist with seed establishment, it is to be applied immediately after seeding.

WEATHER

- Work shall not be performed under adverse field conditions such as frozen soils, excessively wet or dry soil, or soil wetted with snow, ice or standing water.
- Mulching shall not take place when wind conditions are such that material is being carried beyond the designated work areas or that the material is not being uniformly applied.
- Must be applied during calm conditions and dry forecast for > 24 hours.

MATERIALS

- Mulch shall be clean and free of weeds and other foreign matter.
- Mulch shall be 100% biodegradable, compatible with the environment, and shall contain no germination inhibiting components (unless project warrants the use of inorganic mulches).
- Hydraulic mulch materials for use in Banff National Park must be one of the following types:
- Wood Fiber

- Wood fiber mulch is a component of hydraulic applications.
- Wood fiber must be a minimum of 4 mm
- Must be manufactured virgin wood fibers
- Hydraulic Matrix
 - Hydraulic matrix is a combination of wood fiber mulch and tackifier applied as a slurry.
 - Bonded Fibre Matrix (BFM)
 - Bonded fiber matrix (BFM) is a hydraulically-applied system of fibers and adhesives that upon drying forms an erosion-resistant blanket that promotes vegetation, and prevents soil erosion.
 - Note: Cellulose (recycled paper) mulches are not allowed.
 - Tackifier must be capable of joining together the mulch particles to secure the mulch to the ground. The binder shall not form an impervious seal that will prevent the penetration of moisture to underlying soil.
 - Water supplied by the Contractor shall be free of any impurities that might inhibit germination of the seed.

APPLICATION

- Wood Fiber
 - Typically applied at the rate of 2,250 to 4,500 kilograms per hectare (kg/ha) (2,000 to 4,000 lb/ac) with 0-5% by weight of a stabilizing emulsion or tackifier (e.g., guar, psyllium, acrylic copolymer) and applied as a slurry.
- Hydraulic Matrix
 - Typically applied at the rate of 2,250 to 4,500 kg/ha with 5-10% by weight of a stabilizing emulsion or tackifier (e.g., guar, psyllium, acrylic copolymer).
- Bonded Fiber Matrix (BFM)
 - Typically applied at rates from 3,400 kg/ha to 4,500 kg/ha based on the manufacturer's recommendation. The biodegradable BFM is composed of materials that are 100% biodegradable. The binder in the BFM should also be biodegradable and should not dissolve or disperse upon re-wetting. Typically, biodegradable BFMs should not be applied immediately before, during or immediately after rainfall if the soil is saturated. Depending on the product, BFMs require 12 to 24 hours to dry to become effective.

MONITORING AND CONTROL

- Project proponents are responsible for ensure growth of vegetation and controlling non-native vegetation as per their restoration plan.
- Each project require site specific considerations for restoration goals, however general reclamation goals are:
 - <20% Bare soil (>80% Native vegetative cover)
 - No new NNV species present (does not include species that were present pre-disturbance)
 - No increase in NNV present prior to disturbance (similar plant/m2)
 - >80% planting survival (plug and plantings)
- Site inspections should be scheduled by the proponent in order to monitor restoration progress during the year post construction.
- Vegetation and NNV establishment will be assessed before Certificate of Completion is issued.

- Progress will be assessed by the vegetation specialist annually to determine if restoration is on acceptable trajectory.

8.0 REFERENCES

Van Osch Innovations Ltd. (VOI) 2005. Erosion and Sediment Control Participant's Manual. Van Osch Innovations Ltd. Nanaimo, BC.

Government of Alberta (GoA). 2011. Alberta Transportation Erosion and Sediment Control Manual. Available at: <https://www.transportation.alberta.ca/4626.htm>. Accessed: May 2, 2106.

APPROVALS

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APPENDIX A: SEEDING, MULCHING AND EROSION CONTROL SPECIFICATIONS

Table 1: Matrix of Erosion Control Devices and Suitability (Slope and Ground Conditions)

Erosion Control Device	Flat Ground	Sloping Ground	Stockpiles	Ditches	Slope Conditions
Seeding	●	●	●	●	all
Organic Mulches	●	●	●	◇	≤ 1.5H:1V ^(a)
Hydraulic Mulches	●	●	●	◇	≥1.5H:1V to ≤4H:1V (standard application rate) >4H:1V (greater than standard application rate)
Inorganic Mulches	●	●	●	-	≤ 1.5H:1V
Rolled Erosion Control Products	●	●	●	●	all
Organic Fiber Rolls	-	●	-	-	all
Slope Texturing	-	●	-	-	<2H:1V

Note: ● = suitable; ◇ = suitable in some cases; - = not applicable (n/a); H = horizontal; V = vertical; > = greater than; < = lesser than. ^(a) can be applied to greater slopes with the use of rolled erosion control products.

A1.0 - Suitability of Seeding Practices:

Hand and Mechanical Seeding

- Areas where only seed are prescribed
- Where other non-dry seeding practices are not feasible or available
- Small areas where the cost associated with other seeding methods is not warranted
 - o Hand Broadcast
 - Appropriate for small areas
 - Not recommended as a seeding practice

- Hand-opened Rotary Seeders
 - Seeder must calibrate spread rate prior to seeding larger area
 - Relatively large areas can be seeded using this practice ~ 1 ha/hour
- Cyclone Seeders
 - Appropriate for large areas of low sloping soils (3H:1V and flatter) where only seed and fertilizer are prescribed
 - Requires mount onto large piece of equipment (e.g., ATV)
 - Requires calibration of seeder prior to seeding larger area
- Drill Seeding
 - Flat and low gradient soil surfaces that are free of larger rocks and non-soil debris
 - Areas that are accessible by the drill seeding equipment
 - Areas where drill seeding equipment can be operated safely

Hydraulic Seeding

- For large areas. Not recommended. Required approval.

A2.0 - Suitability and Specification of Mulches

1. Organic Mulches

- Can be applied to a range of slope gradients ($\leq 1.5H:1V$) and most soil types

Wood Chips (when prescribed)

- On-site wood waste to be used
- Cannot be seeded prior to application
- Mix at min. 30% wood chips to 70% soil ratio
- Nitrogen may be required at a rate of 22 kg/ha if chip decomposition, soil building, and revegetation is desirable.
- Do not stockpile near water or drainage courses

Wood Fiber

- Min. 4 mm in length
- Applied hydraulically at a min. application rate of 2,250 kg/ha
 - Application rate should increase as soil erodibility increases
- May not have sufficient bulk at standard rates to provide effective erosion control on steeper slopes or erodible soils.

Compost (requires further EA)

- Can be applied to slopes up to 1H:1V
- Should extend 1 to 2 m back from the crest of the slope
- Not to be applied in areas of concentrated water flow

2. Inorganic Mulches

Materials must be specified by a qualified professional if:

- Flowing water will be directed onto and over the inorganic mulch
- Inorganic mulch is used for geotechnical slope stabilization

Gravel

- Fines should be ,4% passing the #200 sieve (<0.074 mm)
If equipment will be driving on gravel mulch, fines should be <2% passing #200 sieve)
- Minimum gravel mulch thickness is 150 mm

Rock

- Minimum $D_{50} = 150$ mm
- Minimum rock thickness = $D_{50} \times 1.5$
- Performance of rock mulch can be improved by placement of 150mm layer of well-graded gravel mulch prior to rock placement

3. Hydraulic Mulches

Standard application rates are suitable under the following conditions:

- Slopes >1.5 H:1V to <4H:1V
- Soils that are low to moderately erodible
- Locations where a vegetation cover can be established quickly.

Higher than recommended application rates are suitable under the following conditions:

- > 4H:1V
- Moderately to highly erodible soils
- Sites where vegetation establishment may be difficult
- Locations where access into site for future erosion control maintenance is challenging.

A3.0 - Organic Fibre Rolls

Minimum Size:

- 225 mm

Minimum spacing:

- 3 m on 1H:1V
- 6 m on 2H:1V
- 9 m on 3H:1V
- 12 on 4H:1

SOIL IMPORT

- Importing soil (internally or externally) is not recommended. Through proper soil management, the majority of sites will not need to import soil, please see “Guidelines: Vegetation Removal and Reclamation”. Proponents wishing to import soil are responsible for all costs associated with analysis and testing does not necessarily mean approval will be granted. For the purpose of this document “origin site” is where the proposed soil is stored, “receiving location” is the project site where soil is being imported to.

Timing and Cost

- The soil import process requires proper planning to account for time-required for sampling by third parties, laboratory turnaround time and Parks Canada admissibility review. This process may take more than 3 weeks to coordinate, and the proponent is responsible for all logistics and costs. The cost for a single sample to be screened for basic criteria is estimated to be roughly \$400-\$600 without including the 3rd party qualified sampling personnel.

Sampling

- A qualified third party must conduct soil sampling and submit to an accredited laboratory.
- Laboratories must be certified under one of the following
 1. The Canadian Association for Laboratory Analysis (CALA)
 2. The Standard Council of Canada (SCC)
- Qualification requirements for sampling personal are;
 1. At least 6 months experience in soil sampling, field botany, reclamation, remediation or spill response.
 2. A certification such as P.Biol, P.Ag, P.Chem, P.Tech – different regulated professionals must be approved by the ESO.

Sample Methodology

- The methodology for origin sampling has the goal of understanding the pile/soil characteristics without cost-prohibitive sampling.
- Composite sampling is the method of using sub-samples for various locations or depths of the pile, mixed thoroughly, to have a representative sample for the pile. This reduces the overall cost of sampling as fewer samples are required. If the pile is found to not be suitable based on analysis, further directed sampling can be conducted in heterogeneous piles to use certain parts.

Origin Form (homogeneous)	Sampling Method	Sampling Plan	Sub Sampling	Depth	# of Sub Samples in composite sample
Soil Pile	Composite	3D Grid (sample center of pile)	1 sub sample/10m ³	Various from surface to center of pile	10 (1 composite sample per 100m ³)
Soil in place (field)	Composite	Grid	1 sub sample/50m ²	Below rooting zone, above sub soil (~15cm)	10 (1 composite sample per 500m ²)

- Methods for soil sample planning (suitable depths, sample sizes and locations) are well documented and qualified individuals can use their discretion.
 1. For homogeneous origin piles (one large pile of same soil type and source)
 - a. Sub Samples must be taken for every 10m³ of soil-
 - b. Composite sampling can be used for up to 10 samples (100m³ of fill)
 2. For heterogeneous origin piles (mixed layers of soil, different sources)
 - a. Samples must be taken for every 10m³ of soil
 - b. Composite sampling between distinct soil types is not allowed

c. Composite samples can be used for each distinct soil type for up to 10 samples (100m³ of fill)

- Alternative sample methodology can be approved by the ESO

Use Table 1 to determine which laboratory tests will be required for the origin pile.

TABLE 1: Analysis Determination

Description of Soil	Description of Soil Characteristics	Analysis Required (see below)
Soil pile - within Banff National Park	Known history – no concerns	1, 2, 3
	Known history – suspected biosolids amendment (animal or plant)	1, 2, 3, 8*
	Known history – suspected biosolids amendment (human/TOB)	1, 2, 3, 4*, 9*
Soil Pile- external to Banff	Known history- industrial, brownfield, commercial	1, 2, 3, 4*, 5*, 8*, 9*, 10*
Soil Pile- external to Banff	Known history- agricultural land (herbicides/pesticide usage)	1, 2, 3, 4*, 5*, 8*, 9*, 10*, 12*, 13*, 14*, 15*, 16*
Soil Pile- All	With known contamination of heavy metals, PAHs, petroleum products or noxious weeds	Not admissible
Engineered Medium ¹	With biosolids of unknown origin	1, 2, 3, 4*, 8*, 9*
	Without biosolids	Technical specifications can be supplied to ESO to determine if analysis is required
Topsoil Amended with known biosolids- external to Banff	Plant origin Biosolids	1, 2, 3, 8*
	Animal Origin Biosolids	1, 2, 3, 8*
	Human Origin Biosolids	1, 2, 3, 4*, 9*
Soil pile of unknown origin	Unknown history	Not recommended- 1, 2, 3, 4, 5*, 8*, 9, 10*, 13*

1. Suppliers of fabricated and engineered medium may have analysis results and can be supplied instead of 3rd party testing.

*= required for 30% samples submitted to lab. EX if 3 samples are being submitted to laboratory, analysis marked with * is only required for 1 of the sampled. If 7 are submitted, 2 samples need to have the * marked analysis.

TABLE 2: Required Parameters

Test Reference	Laboratory Test	Parameters Required
1	Basic Soil – Characteristics	pH, Salinity (EC), Sodicity (SAR), Saturation (%), Texture (particle size), Moist Consistency, CaCO ₃ equivalency (%)

2	Basic Soil- Micro/macro Nutrients	Nitrate, Ammonium, Phosphorus, Potassium, Sulfate, Magnesium, Calcium, Sodium, Chloride, Iron, Zinc, Boron, Copper, Manganese
3	Weed Seed Analysis or Certified Weed Free	Species name and seed % OR Weed Free certification documentation and lot must be referenced.
4	TCLP Leachable Metals	Sb, As, Ba, Be, B, Cd, Cr, Co, Cu, Fe, Pb, Hg, Ni, Se, Ag, Tl, U, V, Zn, Zr)
5	CCME / Alberta Tier 1 Metals in Soil	Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mo, Ni, Se, Ag, Tl, Sn, U, V, Zn
6	Escherichia coli	cfu/mL
7	Fecal Coliforms	cfu/mL
8	Total Coliforms	cfu/mL or equivalent
9	Polyaromatic Hydrocarbons (PAHs)	2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Acridine, Anthracene, B[a]P TPE, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[ghi]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[ah]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, Phenanthrene, Pyrene, Quinoline
10	Total Petroleum Hydrocarbons (TPH)	Fractions- (TEH(C10-C32), TPgH (C5-C10))
11	BTEX	Benzene, Toluene, Xylene, Ethylene
12	Carbamate Pesticides	Aldicarb, Bendiocarb, Carbofuran, Carbaryl, Diuron, Triallate
13	Organochlorine Pesticides / Polychlorinated Biphenyls	Aldrin, Chlordane (alpha), Chlordane (Gamma), DDD1, DDE1, DDT1, Dieldrin, Endosulfan I, Endosulfan II, Endrin, Heptachlor, Heptachlor Epoxide, Hexachlorobenzene, Hexachlorobutadiene, gamma- Hexachlorocyclohexane (Lindane), Hexachloroethane, Methoxychlor
14	Phenoxy Acid Herbicides	2,3,4,6-tetrachlorophenol, 2,4-dichlorophenol, 2,4-dichlorophenoxyacetic acid, 2,4-DP, 2,4,5-Trichlorophenol, 2,4,5-trichlorophenoxyacetic acid, 2,4,6-trichlorophenol, Bromoxynil, Dicamba, Dichlorprop, Diclofop-methyl, Dinoseb, MCPA, MCPP, Pentachlorophenol, Picloram, Silvex
15	Triazine Herbicides	Alachlor, Atrazine, Cyanazine, De-ethylated atrazine, Metolachlor, Metribuzin, Prometryne, Simazine, Trifuralin
16	Organophosphorous Pesticides	Aziniphos-methyl, Chlorpyrifos, Diazinon, Dimethoate, Methyl Parathion, Malathion, Parathion, Phorate, Temephos, Terbufos

The full analysis must be provided to the ESO. The email of the ESO can be added to the chain-of-custody (COC) in order to facilitate rapid information transfer from laboratory to Parks Canada.

Approval Rational

Parameters will be assessed based of Alberta Tier 1 Soil remediation criteria, CCME (Canadian Council of Ministers of the Environment) standards as well as internal risk management and Parks Canada specialists review (aquatics, wildlife, vegetation).

Sampling plans should be submitted/discussed with vegetation specialist prior to conducting sampling.

Reference

The following labs (not an exhaustive list) are able to run or sub contract analysis for the parameters listed above.

1. Maxxam
2. AGAT
3. ALS
4. Exova