

**Vermont Agency of Natural Resources  
Department of Environmental Conservation**

---

**August 15, 2000**

**GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF  
SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN  
VERMONT**

**I.0 PURPOSE**

The purpose of these Guidelines is to provide a process and outline for ski trail design and general guidelines for construction and maintenance of ski lifts and trails in Class A watersheds. These Guidelines are intended to guide design, application, and construction, to facilitate project review, and to reduce the potential for projects to adversely affect water quality. Where particular measures or practices are recommended or advised, the exact means chosen and the extent of their implementation will be determined through the design process, based on site specific conditions, and applied through the various permit programs that govern this type of development and/or its associated impacts.

The ecological significance and fragility of high altitude waters dictates that some sites may be unsuitable for any development even with the use of these guidelines. The process set forth below will help resorts determine where environmentally sound development may be suitable and where it is not .

**2.0 PROCESS AND PROCEDURES**

The intent of developing a design process that incorporates ongoing consultation with ANR is to assure that trail design work is completed with due consideration of a Class A watershed's environmental constraints. There is recognition that a process that involves the ANR from the conception forward will generally result in projects that present the least environmental conflict, meet Vermont Water Quality Standards, and result in expedited permitting processes.

**2.1 Initial Watershed Resources Assessment**

The resort shall collect baseline resource information for use in planning the trail system expansion. Baseline information shall be assembled in narrative and

## **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

mapped form, as appropriate. Mapping shall be done at a scale sufficient for project planning, design, and environmental review. An applicant shall consider and, where appropriate, information should include:

- topography
- soil types and characteristics, including watertable depth, erodibility, depth to bedrock, bedrock outcrops, boulders
- forest/habitat types
- special habitats, both aquatic and terrestrial
- vegetative cover
- water features, including streams, wetlands, springs, ponds, and drainageways that carry snowmelt and stormwater runoff to defined stream channels
- watershed hydrology, including both flood and base flow characteristics
- approximate boundaries for conservation zones, including water features and their buffers and special habitat and their buffers, for the purposes of the initial layout
- existing development, including trail and road systems and structures, within the watershed
- logging history
- aquatic biota supported by streams, wetlands, and ponds; the level of inventory work done should be determined in consultation with the ANR
- threatened and endangered species

### **2.2 ANR Consultation Process**

1. The resort first notifies the ANR Planning Division of its intent to construct or expand lifts and trails above elevation 2500 feet. The Planning Division determines which ANR staff to involve in coordinated review process and informs resort as to

## **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

which staff members will be involved. The resort distributes its future filings directly to those staff members and the Planning Division coordinator.

2. The resort prepares the resource inventory and base map referenced in Section 2.1 above. The resort will also show any areas that it has identified as unsuitable for development.

3. The resort completes a "sketch" level design of system on the resource base map, including access roads and expected clearing area; if trail development has already occurred in the watershed, the resort evaluates opportunities to mitigate existing impacts to waters and includes all reasonable mitigation measures in the design.

4. The resort identifies resource agencies and other regulatory agencies of interest for planning purposes, such as the U.S. Forest Service.

5. The resort files a preliminary plan with ANR and any identified parties of interest. The ANR provides the resort with general comments regarding the proposal and design to the extent feasible based on the amount and nature of the information available.

6. ANR conducts a site visit to determine whether the site conditions are appropriate for the proposed development, with discussion/determination of appropriate buffers (wetlands and streams (including, top of bank definition) and special habitats), alternate approaches to avoid or minimize resource impacts, and types of stream crossings that are desirable and technically feasible; ANR also reviews general adequacy of the baseline information.

7. The resort and ANR determine if major revision or additional information needed before moving to step #8 below, if revision/information is needed, the resort produces revision/information before proceeding. Second site visit may be arranged.

8. The ANR makes preliminary determination of whether proposal is of a location, scale and design that likely will meet Class A standards with the use of these Guidelines or whether additional information must be obtained before a preliminary determination can be made. Considered in the determination will be the extent to which the development avoids disturbance within the conservation zones, the potential for erosion, and the protection of natural drainage characteristics of the mountain. The ANR may request a) grading and drainage plans, based on the extent of earthworks; b) bridge and culvert plans; and c) hydrologic modeling to determine if

## **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

change in watershed hydrology would be significant. The ANR also advises the resort as to what ANR permits may apply in addition to Act 250.

9. The resort produces and files second stage design plans with ANR and other parties for review and comment. The second stage of design includes necessary details on erosion control, project scheduling, and grading work. ANR makes determination as to whether Class A standards are likely to be met. The resort is encouraged to utilize this process as a means of identifying & resolving any potential issues or problem areas prior to initiating the formal permitting process. Notwithstanding the provisions of this section, the resort may at any time initiate the formal permitting process.

10. The Department of Forests and Parks signs off if state lands are involved and if it has found that the proposal will be consistent with any applicable state management plan. The signature of the Department of Forests, Parks & Recreation required by this section does not explicitly or implicitly indicate compliance with any permitting standards or criteria other than consistency with any applicable state management plan.

11. The resort goes forwards with permitting.

### **2.3 Environmental Considerations in Design**

- Minimization of stream crossings
- Use of bridges to maintain channel integrity and, to the extent feasible, the natural condition of the waterbody
- Avoidance of conservation zones, including streams, ponds, and wetlands and their associated buffers (consistency with ANR procedure *Streambank and Lakeshore Vegetation Management Procedure*, June 16, 1996)
- Protection of watershed ecology, including special habitat values
- Aesthetics
- Opportunities to mitigate historical impacts and improve water quality.

# **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

## **3.0 TRAIL CLEARING**

1. Tree clearing should be scheduled for completion during the winter or summer, thus avoiding the spring wet season or extended wet weather conditions. Logging activities may occur during the period mid-October through mid-December only if weather conditions such as early freeze conditions would support prudent and sound logging activities.
2. All trails will be clearly marked at the edges, as well as any trees to remain within trail areas. Trees and shrubs outside the trail limits, and desirable trees within the clearing area, will be protected from damage during clearing and grading operations.
3. Bumper trees will be designated before skidding is initiated and removed after logging operations are completed.
4. A temporary barrier (fence, poly-rope, etc.) outside the dripline of the trees to be retained may be needed to protect vegetation outside the trail area from injury and compaction.
5. Directional felling will be specified as needed to minimize disturbance to adjacent wooded areas resulting from logging operations. This is particularly important at stream buffers.
6. The possibility of windthrow, when tree removal occurs, should be evaluated.
7. Ground winching and directional felling will be used when tree removal is permitted in sensitive areas such as wetlands, stream buffers or steep slopes.
8. Stumps should be cut flush with the ground and/or ground in place instead of grubbed, whenever possible. If the stump is to be removed, a bit of the trunk should be left to pry or pull the stump from the ground.
9. Slash should be precluded from falling or being left in streams, drainage channels, or wetlands.
10. Trees along the edges of trails to be cleared should be stump marked to insure that the trails were established according to the plans presented and approved by the District Environmental Commission or ANR.

# **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

## **3.1 Tree Clearing**

Staging areas, landing areas and logging and skidder roads shall be located within existing trails or skidding and logging roads or within designated cut areas or trail corridors so that usage as well as closing and reclaiming are handled as part of the trail construction. These facilities shall maintain adequate isolation distances from streams and shall be properly drained.

## **3.2 Slash Disposal**

1. Stumps may be buried, burned, ground up, or hauled off to be disposed at an ANR approved stump disposal area. Slash may be chipped, burned, or lopped and scattered, based on the type and volume of slash, site specific conditions, and other resource objectives.
2. Any burning will be in accordance with the requirements and limitations established by the ANR Air Quality Division as well as State forest fire laws and town fire warden permit requirements.
3. Burying of wood products, other than stumps above the seasonal high water table will be considered on a case by case basis, and only after all other alternatives have been considered and determined to be infeasible.
4. Burying shall be avoided in roads or on steep slopes where the proper compaction is unobtainable, or there is danger of eventual soil slippage.
5. Wood products should be marketed to the maximum extent possible. If wood is not marketable, it should be disposed of in an environmentally sound manner reasonably possible, with burning used only where there is no reasonable alternative.
6. Felled trees, slash, and other clearing debris should not accumulate outside of the trail limits, unless specifically authorized. Boulders should be blasted, buried or removed. In some cases, fill slopes will extend beyond trail clearing limits; in those cases, trees that may be damaged by fill will be removed and later replaced by plantings appropriate to stabilize the fill slope.
7. The cutting of brush for trail maintenance will be limited to open trails only. Cutting within gladed trails will be in accordance with an established vegetation management plan, developed in consultation with ANR, which will include location rotation, use characteristics, information on vegetative species to be managed for in

# **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

the gladed area, and monitoring as appropriate.

## **4.0 EARTHWORK AND CONSTRUCTION**

Earthworks and associated erosion control shall follow a systematic plan to minimize the risk to State waters and to reduce the potential for storm damage to the construction site. Work should be done in phases that follow a sequence and schedule that allows permanent stabilization of discrete areas on an ongoing basis and minimizes the potential for large scale erosion problems. Phasing should be used to limit the areal extent of soils that are exposed at any given time. Permanent stream crossings should be constructed early on, and riparian areas disturbed by the related construction should be immediately revegetated.

### **4.1 Grading and Recontouring**

1. In order to reduce the potential for erosion and to assure a vegetative cover for overwintering at construction sites, seasonal limitations shall be determined on a case by case basis through the permitting process and specified as a condition of the permit. Seed and mulch are to be in place by the specified completion date in the permit. Where appropriate, the permit will allow the beginning and ending dates to be adjusted for specific circumstances (eg. expected weather, character of disturbance area existing outside of normal season, technologies available to control erosion potential, and type of work outstanding) with a showing to ANR that an adequate level of protection of water resources will continue to be provided.

2. The extent of grading and recontouring for each project will be determined on a case by case basis in the project design phase, with the intent to minimize grading impacts and soil disturbance. Levels of disturbance ranging from light to heavy modification include:

#### **Light:**

Trees are flush cut and stumps are left in place. To minimize soil disturbance, trees are directionally felled. The duff layer and understory vegetation are intact on at least 50% of the area. Soil profile is intact.

#### **Moderate:**

Spot dozing with limited areas of contour grading to smooth small terrain irregularities, and stumps are buried or removed. Cuts and fills are generally less than 2 feet.

## **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

### **Heavy:**

Contour grading occurs with cuts and fills generally balanced. Cuts and fills are generally greater than 2 feet and are generally limited to the trail corridor. To the extent practical, topsoil is stockpiled for replacement, and stumps are buried or removed. The site specific drainage plan must be consistent with the overall drainage plan. Heavy side hill contouring must be dealt with on a case-by-case basis.

3. Regrading and recontouring will be performed in a manner to maintain existing overall drainage patterns, including catchment areas. It is particularly important to protect natural drainageways that carry water to streams and to avoid the collection and discharge of water into areas that may become destabilized as a result.
4. The area of exposed soils will be minimized, at any time, to that absolutely necessary for project construction.
5. Cuts and fills and complete vegetation removal on extensive areas shall be avoided through the use of project phasing and construction sequencing.
6. Grading will be avoided in areas that cannot be adequately protected from erosion, i.e., areas where revegetation is questionable. This provision is not intended to include areas such as bare rock and ledge that were not originally vegetated and do not pose risks of erosion.
7. Regrading and re-topsoiling of disturbed areas will be performed by moving equipment across the slope, rather than up and down the slope, whenever possible.
8. Dozed surfaces should be left rough or irregular, instead of backbladed smooth. A rough surface will aid in holding moisture and reducing erosion.
9. All erodible cut and fill areas must be backsloped to a degree which will allow proper revegetation, typically, 1.5:1 (H:V) or flatter, but also dependent on site specific conditions.
10. Prior to seeding, a final pass of a tracked vehicle should be made up and down the slope; the resulting indentations in the soil serve to hold seed and moisture, encouraging germination and growth while minimizing erosion of soil and seed. Tracking will be avoided on steeper slopes where tracked construction equipment may damage fragile soils. Mulching with a hydroseeder using a tackifier is is



## **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

preferred. Where hydroseeding is not practical due to slope, aspect, or other access considerations, all reasonable efforts will be made to seed and mulch by hand.

11. The recontoured surface of the graded areas should blend and match grade with the surrounding undisturbed terrain. Clearing width for trees should generally be 6 feet beyond the top of cut, or wide enough to prevent exposure of tree roots, and the formation of a turfcap.

12. Disruption of swales, ephemeral, and runoff channels will be avoided or minimized .

13. In order to reduce compaction, any ground disturbing activities will not begin until soils have adequately dried out.

14. Grading and other ground disturbing activities should not be carried out during periods of heavy precipitation.

15. If heavy rains are anticipated, existing disturbed areas shall be temporarily mulched and an upgradient diversion installed.

### **4.2 Surface Runoff**

1. Detailed BMPs for erosion control can be found in the *Vermont Handbook For Soil Erosion And Sediment Control On Construction Sites*.

2. Runoff from undisturbed areas shall be intercepted and captured, where practical, and prevented from entering the disturbed areas. During construction and restoration, where feasible, runoff should not be concentrated. Natural drainage characteristics should be maintained, and streams should not be relocated.

3. Where possible, all diversion ditches should be built on undisturbed soil rather than on fills, with a discharge into a stable area not prone to erosion.

4. Silt fences or hay bale dikes shall be installed, as needed, and maintained along the lower portion of the disturbed areas to intercept and detain sediment carried across the disturbed area by onsite runoff. Interception of silt is the last line of defense after erosion has already occurred. The focus of erosion control planning should be the use of measures to prevent runoff from crossing disturbed areas (upslope diversion) and to protect disturbed soils from direct rainfall impact and site-generated runoff.

## **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

5. Silt fences should be toed into natural sod, if possible, and otherwise backfilled with fill material. Silt fences must be removed after the area has become stabilized. Silt fences must be carefully located and aligned along the contour to assure that they are functional. The fences shall not be installed across streams.
6. An adequate supply of surface and erosion control materials (silt fence, hay bales, and tools) will be kept onsite at all times for emergencies.
7. The appropriate width of a stream buffer is a case-specific determination and should be made in consultation with ANR using the *Agency of Natural Resources Streambank and Lakeshore Management Procedure*.
8. Cross slope diversions should be constructed on all disturbed soil immediately after final grading, and before revegetation work is completed.
9. Cross slope diversions should meet the following specifications:
  - a. Cross slope diversions should follow natural terrain features.
  - b. The overall grade shall traverse the disturbed area at a constant gradient of less than five percent.
  - c. Cross slope diversions should be constructed by excavating a trench one foot deep and side casting the material to the lower side, creating a water bar approximately 18" deep. Large cross slope diversions, 24 to 30 inches deep, should be used where site conditions require (e.g., base of slope, large flow of water).
  - d. Cross slope diversions must carry the water completely off the disturbed area and spread it as widely as possible on an undisturbed area.
  - e. Energy dissipators should be constructed at the point of cross slope diversions discharge, if necessary. Alternately, the cross slope diversions should terminate in a relatively flat area, or be turned slightly upslope to prevent channelization. The intent of the extension of the cross slope diversion is to increase infiltration and to reduce flow velocity. Cross slope diversions should continue along the contour for as great a distance as possible without disrupting the soil profile of the trail. The discharge direction of the cross slope diversion shall be designed so as not to concentrate flow or increase runoff velocity.

**GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

f. Cross slope diversions should continue along the contour into the woods for a distance sufficient to adequately disperse water. This extension of cross slope diversions may need to be dug by hand in some places, to prevent unnecessary disturbance to the woods. The extension is intended to serve to maintain as nearly as possible, pre-existing runoff characteristics, i.e. overland flow, maximizing infiltration. Careful field location of water bars will be required to insure that the extensions can be constructed

g. Cross slope diversions should discharge on the outside of sharper turns in the trails, and alternate sides on straight runs of trail. Cross slope diversions must ultimately be based on topography and designed in such a way as to minimize alterations of flow velocity or concentrations.

h. Cross slope diversion intervals are a function of both trail gradient and trail width and must be established on a case by case basis. As a general guideline the following maximum spacing is recommended:

<u>Slope</u>	<u>Distance</u>
20%	50'
15-20%	100'
less than 15%	200'

i. Work roads crossing cross slope diversions shall utilize culverts or protected/ armored water bars to minimize damage to the berm.

**4.3 Temporary Construction Trenches**

1. Trenches for power lines, snowmaking, etc. shall be open no more than is necessary. Adequate blow-out protection shall be in place at all times. The length of trench left open and the intervals for construction of blow-out protection should be based on the length of exposure, the extent of area that would contribute flow to the trench during a storm, soils, and the trench bottom gradient, but no intervals without blowout protection should exceed 300 feet. Examples include sandbags, sumps or relief trenches.

2. Vegetation should be stripped and topsoil removed; topsoil should be reserved for replacement after construction is complete.

3. Subsoil should be placed uphill from ditch, to hydrologically isolate soils from

# **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

stream channels.

4. Subsoil should be smoothed or a stabilized roadbed/work road should be provided for construction travel route, to consolidate equipment and vehicle travel to a single corridor, where possible.

5. Work vehicles shall not operate outside of the trail corridor unless necessary due to considerations such as the grade of the trail. Ski resorts shall consolidate travel and shall, where feasible, use established work roads. Restoration shall be done on temporary travel areas that extend outside the trail corridor.

## **4.4 Stream Crossings**

The general goal of these practices with respect to stream crossings is to not disturb the stream channel and to limit the extent of removal of riparian vegetation.

1. Bridges or plate arches are preferable for crossing of upland streams, however the choice of appropriate stream crossing is necessarily site specific. Culverts are more likely to be acceptable on intermittent streams. Note: Bridges are those crossings with abutment footings and piers outside the streambed. Perennial streams are those streams with continuously running water in an average year. Intermittent streams are dry at some time during the year in 50% of the years. The option of using timber bridges should be considered in order to promote use of indigenous, renewable resources and to reduce the construction, maintenance, and aesthetics impacts of concrete and steel structures.

2. When culverts are approved for intermittent streams, work should be conducted during dry weather conditions whenever possible. Water shall be conveyed through the work area without contact with areas disturbed by construction excavation. Several different approaches are commonly acceptable at bridge construction sites including a sand bag dam above the work area with the water pumped or gravity piped (with the latter being preferred) to the flow channel below the work area or a coffer dam to prevent water from entering the work area.

3. A steel arch shall span the normal flow channel. Where a bridge is being used the same requirement applies.

## **4.5 Topsoil Management**

1. On areas that require extensive regrading, a topsoil assessment should be accomplished prior to initiating construction and preferably as part of the site

## **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

assessment in the design process.

2. Topsoil should be considered as any soil material that is suitable as a plant growth medium which will produce a vegetative ground cover capable of preventing surface erosion. Topsoil suitability is dependent on depth, texture, organic matter, fertility, and coarse fragment characteristics. Where vegetation has not taken, corrective steps should be taken immediately using lime and fertilizer, as appropriate and in accordance with Section 5 below.
3. A site specific soils stability validation should be accomplished where roads, lift terminals and towers, and graded trails cross or are sited on areas with potential stability problems (i.e., moderate to high stability hazard) or high erodibility potential.
4. The salvaged topsoil should be securely stored away from active work area, and hydrologically isolated from waters, using a haybale fence or erosion fence. Control of drainage at the stockpile area is needed to assure water quality protection and minimizing the loss of valuable topsoil.
5. All topsoil identified in areas to be graded should be selectively removed from unsuitable subsoils with the minimum amount of soil mixing.
6. Regraded materials should consist of suitable subsoil material upon which topsoil will be respread. Subsoil material should generally not be comprised of rock, boulders, cobbles, gravel, or sand; but should have a relatively high composition of fine sands and silts to provide adequate site drainage yet provide adequate soil moisture storage and rooting depth.
7. In areas of shallow soils over bedrock, a determination will be made as to whether there will be adequate soil depth above bedrock to allow for the spreading of subsoil before topsoil emplacement.
8. Selective boulder removal may be needed to facilitate adequate topsoil resspreading and revegetation.
9. Topsoil, if available from work area, should be respread to a depth normal for the site. All available topsoil from work area should be salvaged, stored and respread. Where possible, the minimum depth of topsoil should be at least three inches.

# GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT

August 15, 2000

## 5.0 REVEGETATION

### 5.1 General Practices

1. Revegetation on any area will generally be needed where ground cover is disturbed. As a general guideline, ground cover should recover to its normal range of variability for the land type and geoclimatic area by the end of the third growing season. Suitable perennial grass species should ultimately dominate the site, although introduced annual species may be used to ensure vegetation cover initially.
2. On high elevation slopes or areas of special erosion concerns, revegetation should commence immediately after the disturbance. While seeding should be done on an ongoing basis as finish grading is completed, all disturbed areas must be seeded and mulched no later than the work completion dates set forth in applicable permits (ref. Section 4.1).
3. If for any reason, seeding must be deferred until later in the construction season, then erosion control measures and mulching need to be applied within 48 hours, or sooner if rain is predicted, after recontouring is completed on all areas with erosion potential.
4. Specific revegetation and restoration efforts consistent with ANR or COE permits will be required where wetlands or wetland buffers are authorized to be disturbed by grading activities (i.e. iron seep prevention measures).
5. Proper procedure for establishing seeded vegetation to stabilize a disturbed area (*Vermont Handbook for Soil Erosion and Sediment Control on Construction Sites*, September 1987):
  1. Prepare seed bed
  2. Choose appropriate seed mix(es)
  3. Apply seed mix(es)
  4. Apply mulch and anchor if necessary
  5. Periodically inspect and perform necessary maintenance

### 5.2 Seed Bed Preparation

1. Surfaces should be left irregular or roughened, similar to a disked field, rather than backbladed smooth.
2. Soil surface should consist of sufficient topsoil when available.

## **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

3. Compacted areas shall be scarified and loosened by a disk, harrow, or hand rake, as needed to allow for seeding to proceed.
4. Rills or gullies which have formed should be filled and leveled to prevent further erosion.

### **5.3 Seeding**

1. Seed mixtures should be designed based on site-specific conditions of a particular area (i.e. elevation, aspect, vegetation community type, site moisture, soil type, etc.), to meet the specific objectives of revegetation. Species name and variety, germination percent, and pure live seed should be specified on the bag.
2. Seed should consist of suitable species and varieties. Grasses are generally recommended for most sites because they are easy to establish and maintain. If non-native species are demonstrated to not be overly aggressive and allow for establishment of native species, then seed mix containing non-natives may be used, such as sterile wheat or winter rye.

As stated under 5.3.1, the specific mix needs to be determined based on the site conditions. The mixtures and seeding rates outlined in Vermont Ski Trail Construction and Maintenance Pamphlet #39, should be used for general guidance.

3. The timing of seed application in Vermont is critical due to the short growing season. All disturbed areas should be seeded and stabilized by the dates set forth in applicable permits (ref. Section 4.1) to allow seed to take prior to cold weather.
4. If work is allowed to extend past the dates set forth in applicable permits, a dormant seeding may be made after those dates, but before soil freeze-up. Germination will be delayed until spring, and some reseeding will be needed following spring snowmelt. Use of appropriate erosion control materials for areas stabilized late in the season is required.
5. Broadcast seeding should be at a rate of at least 40 to 60 lbs per acre.
6. If needed, seed should be lightly raked or harrowed into the soil.
7. The seed mixture shall be evenly and uniformly planted over the disturbed area.

## **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

### **5.4 Fertilization and Liming**

1. Fertilizer may be used on problem areas where lack of adequate topsoil and other site conditions would prevent the establishment of an adequate ground cover. Soil tests shall be conducted as necessary for proper selection of fertilizer mixes and application rates. The Agricultural Extension Service or other similar resources may be consulted to determine needs of the soil for fertilization.
2. Lime should be added, as needed, to increase the pH of the soil. The addition of lime is important so nutrients are available to plants. Test the soil with a soil test kit to determine pH.
3. If practical, lime and fertilizer should be incorporated into the soil using a rake or other means to a minimum depth of 2 inches. This prevents washing and makes the nutrients available to the plant roots.
4. Chemical fertilizers present a risk of nutrient enrichment and accelerated algal growth in the waters. Soil tests shall be done to select the correct fertilizer mix and liming rate.

### **5.5 Mulching**

1. Mulching or use of erosion control blankets will be needed in most situations where there is soil disturbance.
2. Hay and straw are the most commonly used and easily available mulch materials. Other mulching materials include: hydromulch (1,500 lbs per acre), wood fiber, and mulch tackifiers. They should be applied at a rate of 1½ to 2 tons per acre.
3. Care shall be taken to avoid excessively thick (greater than three inches in depth) applications of mulch.
4. Crimping, tackifying, and netting may be needed to bind the loose mulch to the soil surface to minimize removal by wind or surface runoff. The method selected should be determined by the condition of the area.
5. A tackifier may be used after replacement of topsoil to reduce the potential for soil loss. The rate should be 90 to 100 lbs/acre.
6. Each revegetated site should be evaluated regularly in order to determine success.



# **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

7. High traffic areas need to be fenced off or identified in some way until revegetation is established.

## **5.6 Irrigation**

1. During the hot, dry period which runs from late June to mid-August in Vermont, care must be taken to mulch and water the seed where practical. When possible or dictated by abnormally dry weather, the snowmaking system, or any watering system, may be utilized to facilitate seed germination and the establishment of young plants. If practical, irrigation should be considered in extremely dry weather but in such cases ski area operators must also be mindful of the need to protect flows in any source stream. Where irrigation water is to be directly or indirectly supplied by a water withdrawal, the ANR should be consulted on how stream flows will be protected consistent with state flow standards.

## **6.0 BMP MONITORING**

1. During construction, daily ground checking of water bars, arch piping, and culverts will occur during periods of spring runoff and moderate or high rainfall intensity. The crew doing this checking must be equipped to repair and maintain control structures. Except for minor projects, construction oversight in Class A waters shall include the review and oversight of a registered professional engineer. The engineer shall periodically visit the construction site at reasonable intervals defined in the erosion control plan and shall maintain a record of work status observations relative to erosion control and any recommendations for revisions to the erosion control plan.

2. Following construction in Class A watersheds, monitoring should be implemented to determine long-term BMP effectiveness in the following areas:

- Revegetation success
- Sheet and rill erosion, gullies, slumping, and subsidence
- Effectiveness of erosion control measures
- Condition and effectiveness of water bars and stream crossings
- Noxious and undesirable weed invasion

## **GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

3. The following post-construction performance standards should be used to determine whether the objectives of the erosion control and revegetation plan have been met at a given time. A reference transect should be established for baseline conditions.

- Percent cover - 75% of the total vegetation cover measured for the reference transect.
- Dominant Species - 90% of the revegetation consists of species contained in the applied seed mix and that occur in the reference transect.
- Seedling Density - A reasonable unit-area density and distribution of seedlings.
- Erosion Condition/Soil Surface Factor - Erosion condition of the reclaimed area is equal to or in better condition than that measured for the reference transect.

4. Photographs should be taken by the ski area each year for 3 years following construction, at established points to document the reclamation effort and maintain a consistent photographic record.

5. The ski area shall have a follow up program in place for fertilizing ski trails to maintain grasses. Soil tests shall be used to assure that the fertilizer application rates match soil needs.

6. Significant problems identified in the post-construction monitoring shall be reported to the ANR with an indication of the actions that have been or will be taken.

### **7.0 REFERENCES**

Vermont Handbook for Soil Erosion And Sediment Control On Construction Sites, Special Publication No. 3, Vermont Geological Survey, Montpelier, VT, Revised September 1987.

Guide to Vermont Ski Trail Construction And Management, Pamphlet 39, Agricultural Experiment Station, UVM, undated.

**GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF SKI LIFTS AND TRAILS IN CLASS A WATERSHEDS IN VERMONT**

August 15, 2000

Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont, VT. Dept. Of Forests, Parks and Recreation, 1982.

Lake Catamount Resort, Final Environmental Impact Statement, Vol. 1, Nov. 1990.

Winter Sports Guidebook, USDA, Forest Service, Rocky Mtn. Region, June 1992.

Routt National Forest Land and Resource Management Plan Watershed Conservation Practices Handbook, USDA-RM, March 1995.

Erosion Control Manual, Colorado Dept. Of Highways, October 1978.

US Forest Service Standards for the Green Mountain National Forest, USFWS, 1984

JEFF d:\...ski\BMPs\BMPs VI ANR.wpd



---

Canute E. Dalmasse, Commissioner  
Department of Environmental Conservation

**Notes regarding *Guidelines for the Design and Construction of Ski Lifts and Trails in Class A Watersheds in Vermont***

**Section 2.3:** In 2005, the buffer procedure was replaced by *Guidance for Agency Act 250 and Section 248 Comments Regarding Riparian Buffers*.

**Section 4.2(1):** The erosion control handbook has been substantially revised and updated.