Alaska State Parks

Trail Management Handbook

May 2015

Introduction

Complementary to the Alaska State Parks Trail Management Policy, (Appendix F) the Division of Parks and Outdoor Recreation has developed a reference guide that incorporates the necessary detail for implementation. This handbook will be an iterative publication that will start with the basics of pertinent trail guidelines and will grow over time with regular updates or as necessary. The Handbook is intended to be used as a practical, hands-on tool to help improve the consistency of trail management throughout the State. It is the intent of the Division to adapt this to a field-size guide in the future.

Section 1: Trail Management Objectives (TMOs)

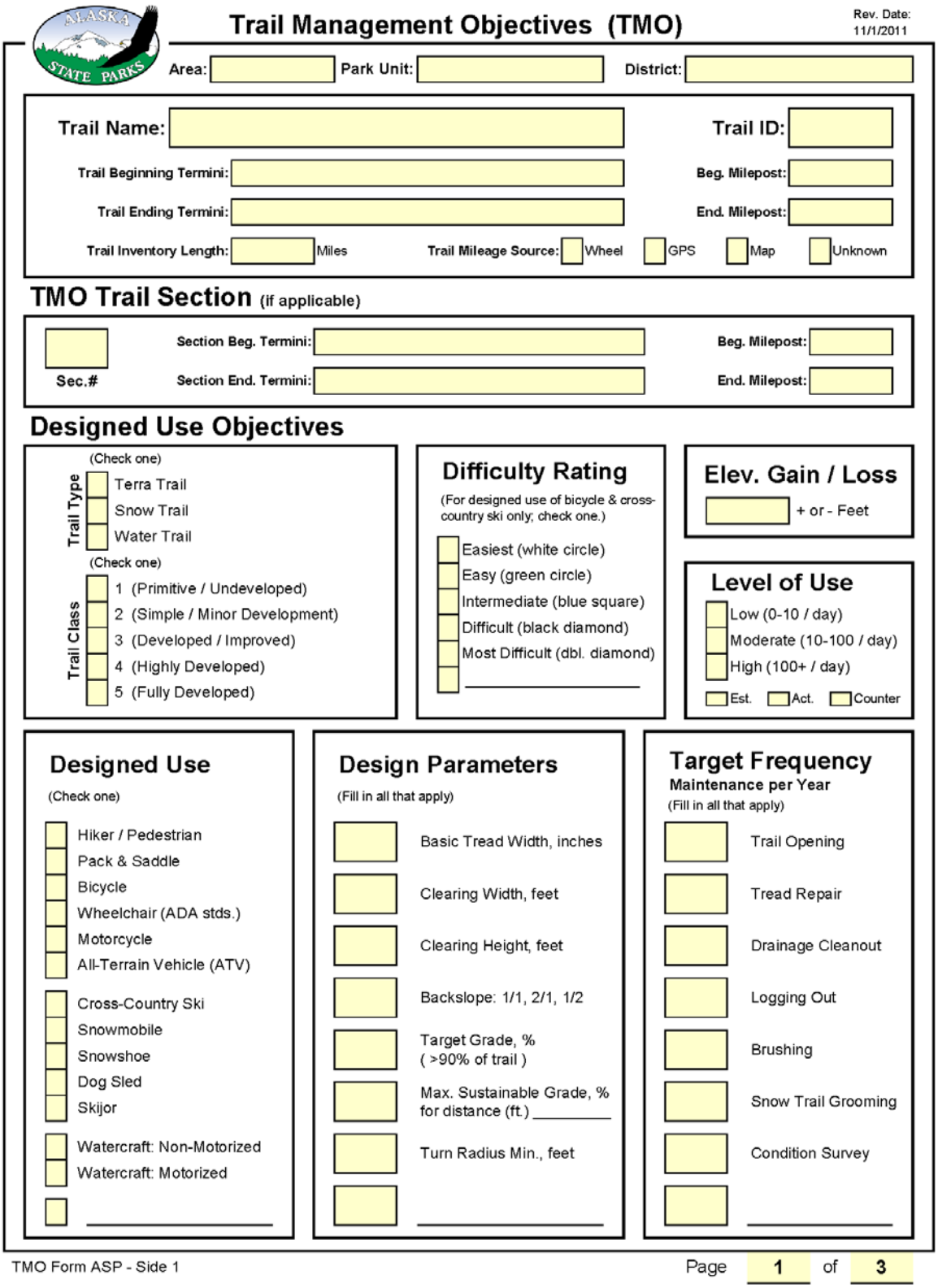
Trail Management Objectives (***TMOs***) that Alaska State Parks uses are a close adaptation of the National Trail Classification System that has been formally adopted by the United States Forest Service (USFS), and can be referenced in USFS Trail Assessment and Condition Surveys (TRACS) course material.

Trail Management Objectives are the most important tools that can be utilized in the management of a trail system for determining how individual trails will be developed, used, and maintained. A properly written TMO can be used to identify the types of use that will occur on a trail, how much use it is expected to receive, and how much maintenance will be required once it is built. Specifically, TMOs document ***Designed Use***, ***Managed Use***, and ***Design Parameters*** for both planned *and* existing trails. For existing trails, TMOs can be an effective tool to determine if a trail is being properly managed or if it is meeting intended standards or objectives.

As identified in the Alaska State Parks, Trail Management Policy (Appendix. F), *all* Alaska State Parks' managed trails will have TMOs developed based on management plan direction and a trail's specified Designed Use. Absent of a trail management plan, TMOs should be developed with consideration given to how individual TMOs accommodate public need, protect resources, and are sustained in the future.

The following pages include a blank TMO document to be used by field and management staff. Instructions and a sample TMO have also been provided. It is important that all finalized documents have been approved by the Park Area Manager. Once approved, a copy of the TMO should be filed with the State Trails Program Office.

1.1 Trail Management Objectives Form



Trail Management Objectives (TMO)

Rev. Date: 11/1/2011

Area: | Park Unit: | District:

Trail Name: | Trail ID:

Trail Beginning Termini: | Beg. Milepost:

Trail Ending Termini: | End. Milepost:

Trail Inventory Length: ____ Miles | Trail Mileage Source: ☐ Wheel ☐ GPS ☐ Map ☐ Unknown

TMO Trail Section (if applicable)

Sec.# | Section Beg. Termini: | Beg. Milepost:

Section End. Termini: | End. Milepost:

Designed Use Objectives

Trail Type (Check one)
- ☐ Terra Trail
- ☐ Snow Trail
- ☐ Water Trail

Trail Class (Check one)
- ☐ 1 (Primitive / Undeveloped)
- ☐ 2 (Simple / Minor Development)
- ☐ 3 (Developed / Improved)
- ☐ 4 (Highly Developed)
- ☐ 5 (Fully Developed)

Difficulty Rating

(For designed use of bicycle & cross-country ski only; check one.)
- ☐ Easiest (white circle)
- ☐ Easy (green circle)
- ☐ Intermediate (blue square)
- ☐ Difficult (black diamond)
- ☐ Most Difficult (dbl. diamond)
- ☐ _____

Elev. Gain / Loss

____ + or - Feet

Level of Use
- ☐ Low (0-10 / day)
- ☐ Moderate (10-100 / day)
- ☐ High (100+ / day)

☐ Est. ☐ Act. ☐ Counter

Designed Use

(Check one)
- ☐ Hiker / Pedestrian
- ☐ Pack & Saddle
- ☐ Bicycle
- ☐ Wheelchair (ADA stds.)
- ☐ Motorcycle
- ☐ All-Terrain Vehicle (ATV)
- ☐ Cross-Country Ski
- ☐ Snowmobile
- ☐ Snowshoe
- ☐ Dog Sled
- ☐ Skijor
- ☐ Watercraft: Non-Motorized
- ☐ Watercraft: Motorized
- ☐ _____

Design Parameters

(Fill in all that apply)
- ____ Basic Tread Width, inches
- ____ Clearing Width, feet
- ____ Clearing Height, feet
- ____ Backslope: 1/1, 2/1, 1/2
- ____ Target Grade, % (>90% of trail)
- ____ Max. Sustainable Grade, % for distance (ft.) _____
- ____ Turn Radius Min., feet
- ____ _____

Target Frequency

Maintenance per Year

(Fill in all that apply)
- ____ Trail Opening
- ____ Tread Repair
- ____ Drainage Cleanout
- ____ Logging Out
- ____ Brushing
- ____ Snow Trail Grooming
- ____ Condition Survey
- ____ _____

TMO Form ASP - Side 1

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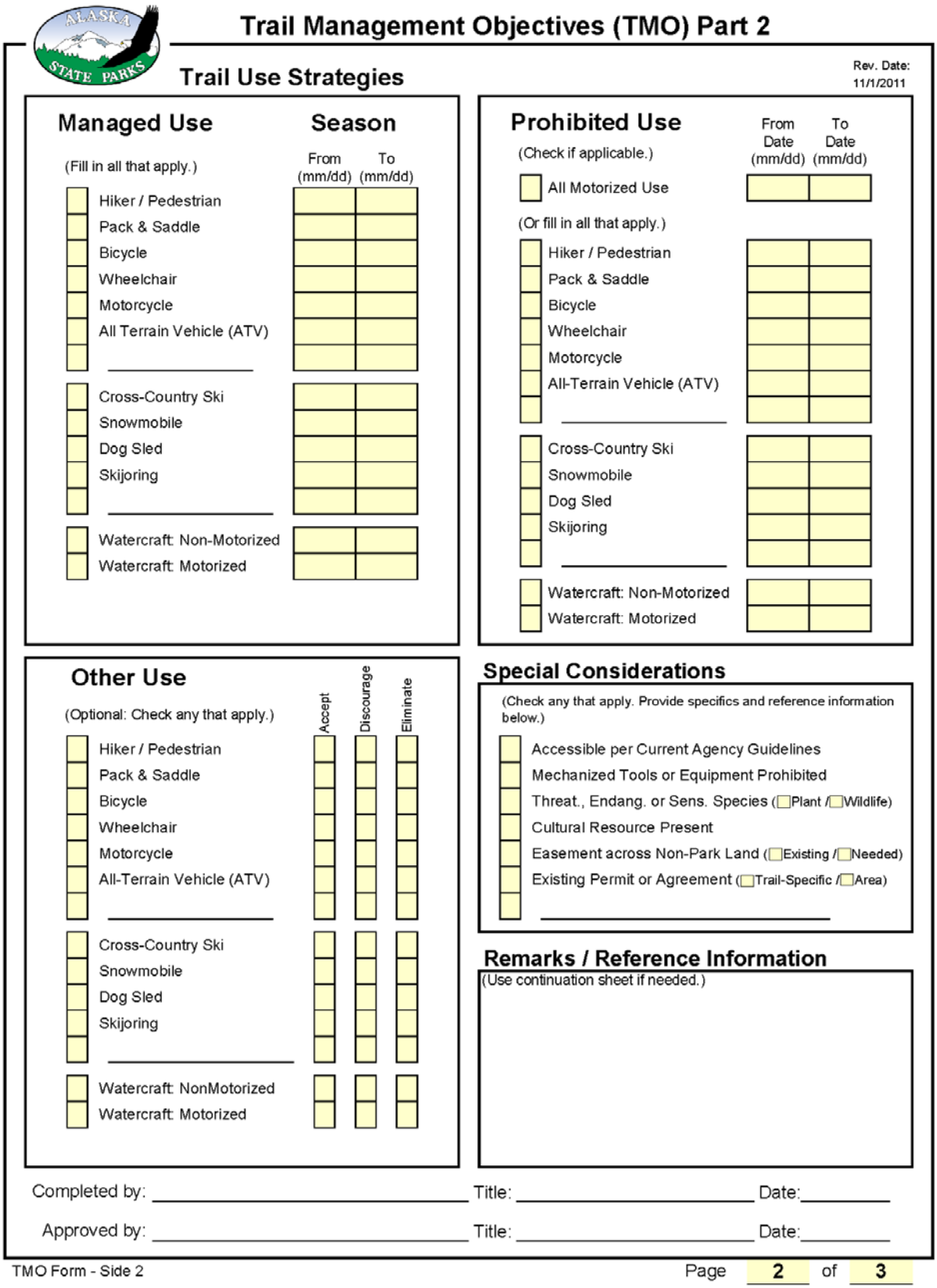
Figure 1.1 – Trail Management Objectives Form



Trail Management Objectives (TMO) Part 2

Trail Use Strategies

Rev. Date: 11/1/2011

Managed Use — Season (From (mm/dd) / To (mm/dd))

(Fill in all that apply.)

- ☐ Hiker / Pedestrian
- ☐ Pack & Saddle
- ☐ Bicycle
- ☐ Wheelchair
- ☐ Motorcycle
- ☐ All Terrain Vehicle (ATV)
- ☐ _____
- ☐ Cross-Country Ski
- ☐ Snowmobile
- ☐ Dog Sled
- ☐ Skijoring
- ☐ _____
- ☐ Watercraft: Non-Motorized
- ☐ Watercraft: Motorized

Prohibited Use — From Date (mm/dd) / To Date (mm/dd)

(Check if applicable.)

- ☐ All Motorized Use

(Or fill in all that apply.)

- ☐ Hiker / Pedestrian
- ☐ Pack & Saddle
- ☐ Bicycle
- ☐ Wheelchair
- ☐ Motorcycle
- ☐ All-Terrain Vehicle (ATV)
- ☐ _____
- ☐ Cross-Country Ski
- ☐ Snowmobile
- ☐ Dog Sled
- ☐ Skijoring
- ☐ _____
- ☐ Watercraft: Non-Motorized
- ☐ Watercraft: Motorized

Other Use — Accept / Discourage / Eliminate

(Optional: Check any that apply.)

- ☐ Hiker / Pedestrian
- ☐ Pack & Saddle
- ☐ Bicycle
- ☐ Wheelchair
- ☐ Motorcycle
- ☐ All-Terrain Vehicle (ATV)
- ☐ _____
- ☐ Cross-Country Ski
- ☐ Snowmobile
- ☐ Dog Sled
- ☐ Skijoring
- ☐ _____
- ☐ Watercraft: NonMotorized
- ☐ Watercraft: Motorized

Special Considerations

(Check any that apply. Provide specifics and reference information below.)

- ☐ Accessible per Current Agency Guidelines
- ☐ Mechanized Tools or Equipment Prohibited
- ☐ Threat., Endang. or Sens. Species (☐Plant /☐Wildlife)
- ☐ Cultural Resource Present
- ☐ Easement across Non-Park Land (☐Existing /☐Needed)
- ☐ Existing Permit or Agreement (☐Trail-Specific /☐Area)
- ☐ _____

Remarks / Reference Information

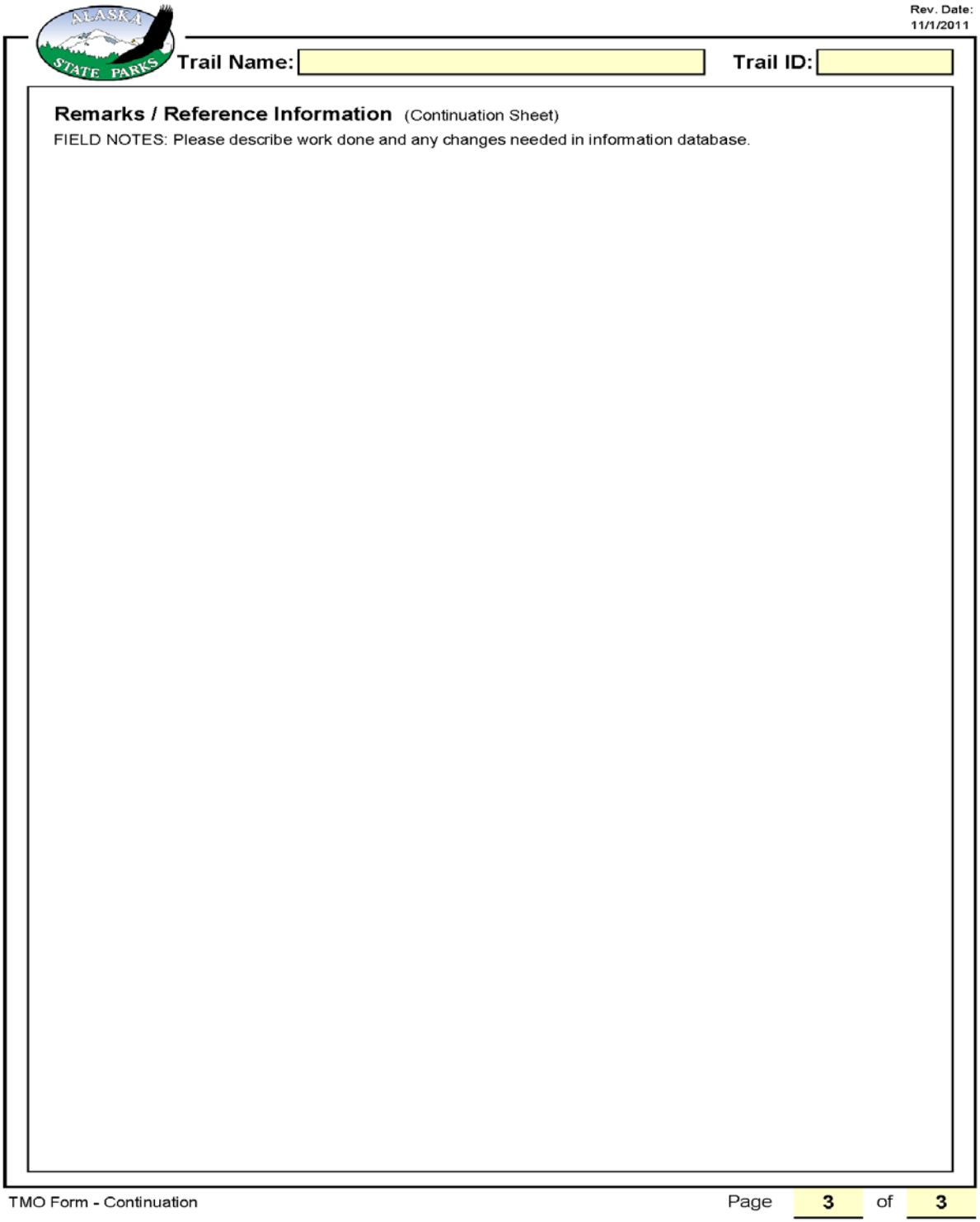
(Use continuation sheet if needed.)

Completed by: _____ Title: _____ Date: _____

Approved by: _____ Title: _____ Date: _____

TMO Form - Side 2 Page 2 of 3

1.2 Trail Management Objective Form Instructions



Rev. Date:
11/1/2011

Trail Name: Trail ID:

Remarks / Reference Information (Continuation Sheet)

FIELD NOTES: Please describe work done and any changes needed in information database.

TMO Form - Continuation Page 3 of 3

Area / Park Unit / District: Enter the *area* name, *park unit* name, and *district* name.

Trail Name and Trail ID: Enter the official *trail name* and *trail ID* number (if used).

Trail Beginning and Trail Ending Termini: Enter a brief narrative description identifying the location of *the trail beginning and trail ending termini*.

Beginning and Ending Mileposts: Enter the *beginning milepost* (or measure point) and the *ending milepost* for the trail.

Trail Inventory Length: Mileage accuracy should correspond to the method of collection (trail mileage source):

- If the actual length is unknown, or determined by vehicle, use no more than one decimal place of accuracy = 3.6.
- If the length was collected by GPS, use two decimal places = 3.64.
- If the length was wheeled with a cyclometer (mile-wheel), use one decimal places = 3.6.

Trail Mileage Source: Check the box that corresponds to the source of the mileage above.

1.2.1 TMO Trail Section:

A trail may have different TMOs for sections of the trail that are, or will be, managed differently. Normally this occurs when a TMO variable changes along distinct portions of the trail, like between junctions or destinations. Examples can include changes in *trail class*, *design parameters*, or *prohibited uses*.

If applicable, use the TMO Trail Section block to identify individual TMOs by trail section. If not applicable, leave this section blank.

Section #: Enter a number or letter to sequentially identify the trail section and corresponding TMO (i.e. Segment #: 1, 2, 3, etc.).

Section Beginning and Ending Termini: Enter a brief narrative description identifying the location of the *section beginning and ending termini* for this trail segment.

Section Beginning and Ending Milepost: Enter the *section beginning and ending milepost* (or measure point) for this trail segment.

1.2.2 Designed Use Objectives

Trail Type: A fundamental trail category that indicates the predominant trail surface or trail foundation, and the general mode of travel the trail accommodates.

The *trail type* differentiates between the three basic types of trails: ***terra*** (standard), ***snow***, or water.

- Assign one *trail type* for the trail.

Trail Class: The prescribed scale of trail development, representing the intended design and management standards of the trail.

- Assign the most appropriate *trail class* for the trail or trail segment. If more than one *trail class* is assigned to the trail, identify each *trail class* by individual trail segment (see *TMO trail section* above). Only one *trail class* may be applied to any trail or trail segment.

1.2.3 Difficulty Rating

The *difficulty rating* is the degree of challenge a trail presents to an average user's physical ability and skill, based on trail condition and route location factors such as alignment, steepness of grades, gain and loss of elevation, and amount and kind of natural barriers that must be crossed.

Assign a *difficulty rating* only for trails with a *designed use* of biking or cross-country skiing. Assign only one rating of the trail based on the criteria identified as follows:

a. ***Easiest***: Requiring little skill and challenge to traverse. Symbol: White circle with black outline.

b. ***Easy***: Requiring little skill and challenge to traverse. Symbol: Green circle.

c. ***Intermediate***: Requiring little skill and involving limited challenge to traverse. Symbol: Blue square.

d. ***Difficult***: Requiring some skill and involving some challenge to traverse. Symbol: Black diamond.

e. ***Most Difficult***: Requiring a high degree of skill and involving a high degree of challenge to traverse. Black double-diamond.

1.2.4 Elevation Gain/Loss

Enter the overall elevation changed along the trail or trail segment. If there is net gain in elevation, use the **+** (positive) symbol, if net loss in elevation, use the **–** (minus) symbol. Use the following formula:

- Highest Elevation Point (feet) – Lowest Elevation Point (feet) = Total Elevation Change

1.2.5 Level of Use

The *level of use* is an indicator of the levels of use on a trail or trail segment, to help establish and review scheduling for maintenance, patrols, and assessments. It can also help identify whether a trail is properly designed to accommodate target use levels.

- Enter use based on numbers of visitors per day. Also indicate the source of values, whether the numbers are estimated counts (*Est.*), actual counts (*Act.*), or some type of mechanical counter (*Counter*).

1.2.6 Designed Use

The *designed use* is the intended use that controls the desired design of the trail, and determines the subsequent maintenance parameters for the trail.

The *designed use* must be identified for each trail or trail segment. It identifies the single use or limiting factor that drives technical design parameters for the trail (i.e. tread width, grade, turning radius, etc.). The *designed use* is necessary to establish the trail's geometric design standards from which the trail is designed, constructed, operated, and maintained, While several *managed uses* may occur on the trail, there is only one *designed use* for any given trail or trail segment.

- Select only one *designed use* per trail or trail segment.

1.2.7 Design Parameters

Design Parameters are technical specifications for trail construction and maintenance, based on the *designed use* and *trail class*.

Design parameters identify the technical specifics that drive trail design, construction, maintenance, and subsequent reconstruction. Choose these carefully. Other criteria (backslope angle for example) are also important but are generally site-specific and require sound engineering judgment to fulfill the objectives.

- Assign a specific value for each of the *design parameter* variables listed. This is not intended to be an all-encompassing list of specifications, but a list of only the dominant criteria that most defines the geometric shape of the trail. If a range of values is listed on the *design parameters*, select a specific value that reflects the prescription for the trail.
- Add any additional fields and values that are deemed important to this specific segment of trail and are necessary for achieving the trail objectives.

1.2.8 Target Frequency

For routine maintenance tasks, each trail requires a recurring maintenance interval in order to keep it functional, stable, and useable. For example, brush grows at a certain rate and to keep a trail operational, the brush must be cut at regular intervals. These intervals are generally site or area-specific, and require local experience to define.

- For the applicable tasks, define the maintenance interval that best reflects the frequency necessary to keep this trail or trail segment to standard. Any period within that interval should be considered "to standard".

- The interval is expressed in years.

Examples:

Table 1.1 - Target Frequency

Task:	Frequency:	Recorded As:
Trail Opening	once every year	1.0
Brushing	once every 3 years	0.33
Logging Out	two times per year	2.0

1.2.9 Trail Use Strategies

Trail Use Strategies are very important to consider and are routinely overlooked. Establishing *trail use strategies* for each trail helps the manager balance the needs of conflicting uses, guides the manager on operational tradeoffs, and assists maintenance crews to efficiently target maintenance efforts to only necessary tasks.

Managed Use: The modes of travel that are actively managed and appropriate, considering the design and management of the trail.

Managed use indicates a management decision or intent to accommodate and/or encourage a specified type of trail use. Accommodating the *managed use* frequently results in user-specific trail maintenance and/or signing needs and costs. This if different from *designed use,* since a trail can have many *managed uses*. However, just because a trail can accommodate a particular type of use, does not mean this use should be checked – only those uses that are actively managed should be identified. For example, a winter trail may be passable by a hiker in the summer, but is not actively managed for that use since it would require very different development standards to make it sustainable during the summer season.

- Record any use that is actively managed on the trail or trail segment.
- There may be more than one *managed use* per trail or trail segment.

Season: The *managed use season* specifically defines the period of the time that the trail is available and managed in a safe condition for the defined user. It is intended to bracket the times that the park is responsible for providing that opportunity.

Examples:

- One obvious example would be when the trail is covered by snow and outside of the *managed use season*. During this time, the park does not intend to provide an accessible tread as this would require snow removal and is not part of the managed trail opportunity. Conversely, during the defined *managed use season*, the park intends to maintain the accessible tread in a safe and functional condition.

- A less obvious example would be if the trail has a "*hiker/pedestrian*" *managed use* defined with a *managed use season* of use from March 1 to November 15. In this case, the park would be responsible for providing stream crossings during high water in June (i.e. trail bridges). Changing the *managed use season* of use for the same example to June 30 to November 15, thus bypassing the June run-off, would alleviate this conflict and clearly define management expectations.

Prohibited Use: Mode of travel prohibited by official legal order.

- Record any use that is prohibited by an official prohibition or closure order.
- Document the dates during which the use is prohibited.
- Footnote and cite the specific statute, regulation, or director's order under *remarks / reference information*.
- If the dates are condition-specific (such as snowfall dependent), enter "typical" dates and footnote that in the *remarks / reference information* section below

Other Use: This section is provided to document additional trail-specific information as needed.

- Check whether the use is *accepted* (allowed, while not actively managed for), *discouraged*, or *eliminated*.

1.2.10 Special Considerations

Use this area to identify any additional considerations that trail managers, design, construction, or maintenance personnel should be aware of.

- Check any special considerations for the trail or trail segment; mark an appropriate clarifier within parentheses if applicable.

1.2.11 Remarks / Reference Information

Use this area to provide additional information or clarification, or to cite reference decisions and materials related to information documented earlier in the TMO. When clarifying information documented in previous sections of the TMO, it is recommended that a footnote be added next to the TMO entry, followed by a footnoted explanation in the *remarks / reference* section.

Example:

Footnoted Items in TMO Sections

Design Parameters

Basic Tread Width, inches	24"[1]

Maintenance Frequency

Trail Opening	1[2]

Special Considerations

Threatened, Endangered, or Sensitive Species Present	X[3]

Footnote Explanations in Remarks:

Remarks / Reference Information

[1] Tread width exceptions allowed at existing wood trail structures.
[2] Complete annual trail opening by 6/15.
[3] Orange Hawkweed, invasive plant located in first mile of trail; refer to 3/15/2006 for Smith Ridge Trail for mitigation purposes.

Figure 1.2 – Footnotes / Remarks

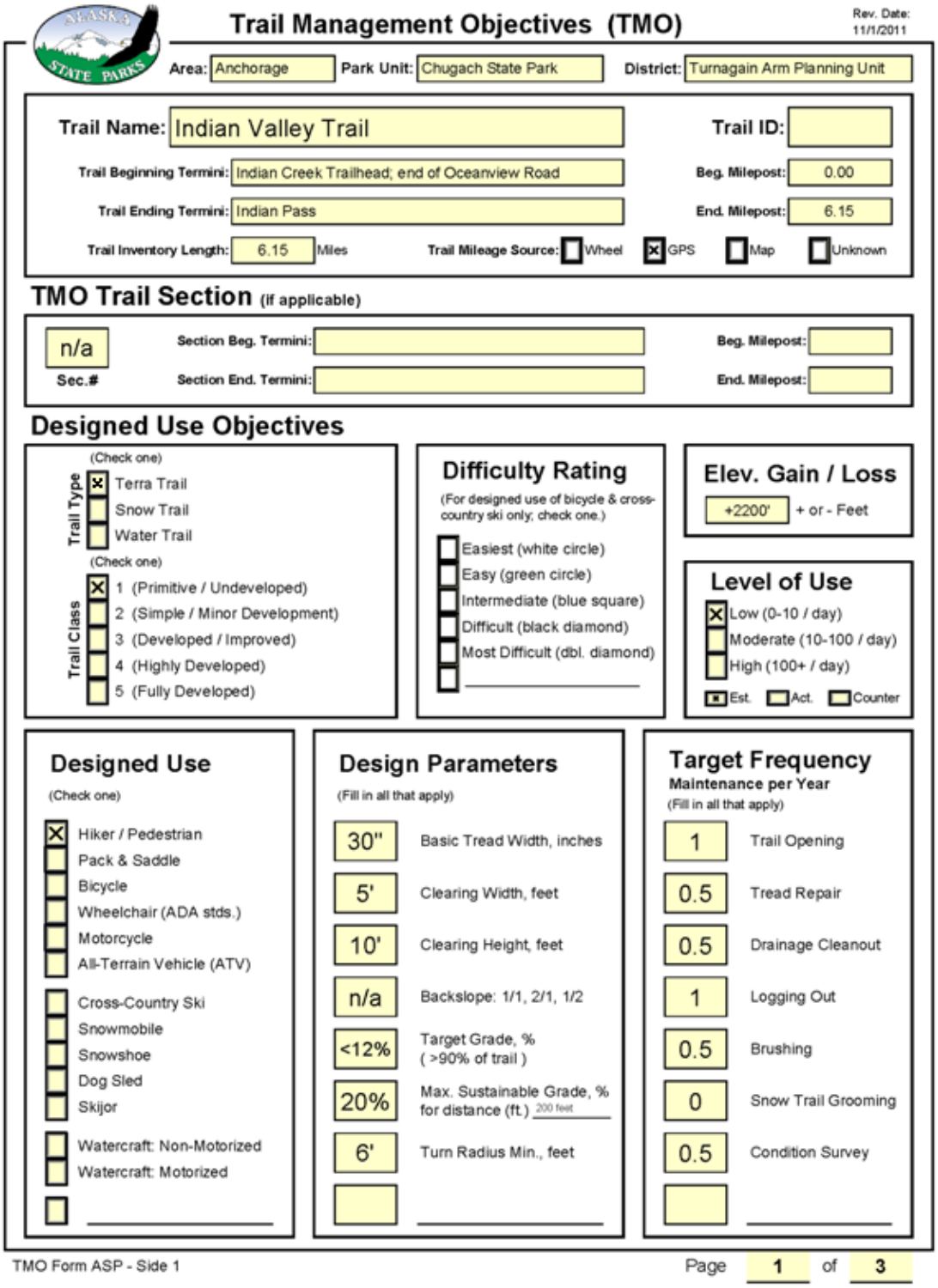
1.2.12 Manager Approval

Having the area manager approve the *trail management objectives* is essential. A properly completed TMO form documents and clarifies management direction across all levels and expectations for a trail. An approved TMO provides the trail manager and the trail maintenance crews with the key tool they need to confidently work on the trail without having to second-guess operational and maintenance choices.

The TMO establishes the base standards against which trail condition surveys and prescriptions are measured and completed. It also ensures a management framework of continuity and consistency over time and through personnel changes.

An example of a completed TMO is given on the following pages.

1.3 Trail Management Objectives Form: Example



Trail Management Objectives (TMO)

Rev. Date: 11/1/2011

Area: Anchorage | Park Unit: Chugach State Park | District: Turnagain Arm Planning Unit

Trail Name: Indian Valley Trail | Trail ID:

Trail Beginning Termini: Indian Creek Trailhead; end of Oceanview Road | Beg. Milepost: 0.00

Trail Ending Termini: Indian Pass | End. Milepost: 6.15

Trail Inventory Length: 6.15 Miles | Trail Mileage Source: ☐ Wheel ☒ GPS ☐ Map ☐ Unknown

TMO Trail Section (if applicable)

n/a (Sec.#) | Section Beg. Termini: | Beg. Milepost:

Section End. Termini: | End. Milepost:

Designed Use Objectives

Trail Type (Check one)
- ☒ Terra Trail
- ☐ Snow Trail
- ☐ Water Trail

Trail Class (Check one)
- ☒ 1 (Primitive / Undeveloped)
- ☐ 2 (Simple / Minor Development)
- ☐ 3 (Developed / Improved)
- ☐ 4 (Highly Developed)
- ☐ 5 (Fully Developed)

Difficulty Rating

(For designed use of bicycle & cross-country ski only; check one.)
- ☐ Easiest (white circle)
- ☐ Easy (green circle)
- ☐ Intermediate (blue square)
- ☐ Difficult (black diamond)
- ☐ Most Difficult (dbl. diamond)
- ☐ _____

Elev. Gain / Loss

+2200' + or - Feet

Level of Use
- ☒ Low (0-10 / day)
- ☐ Moderate (10-100 / day)
- ☐ High (100+ / day)

☒ Est. ☐ Act. ☐ Counter

Designed Use (Check one)
- ☒ Hiker / Pedestrian
- ☐ Pack & Saddle
- ☐ Bicycle
- ☐ Wheelchair (ADA stds.)
- ☐ Motorcycle
- ☐ All-Terrain Vehicle (ATV)
- ☐ Cross-Country Ski
- ☐ Snowmobile
- ☐ Snowshoe
- ☐ Dog Sled
- ☐ Skijor
- ☐ Watercraft: Non-Motorized
- ☐ Watercraft: Motorized
- ☐ _____

Design Parameters (Fill in all that apply)

30"	Basic Tread Width, inches
5'	Clearing Width, feet
10'	Clearing Height, feet
n/a	Backslope: 1/1, 2/1, 1/2
<12%	Target Grade, % (>90% of trail)
20%	Max. Sustainable Grade, % for distance (ft.) 200 feet
6'	Turn Radius Min., feet

Target Frequency
Maintenance per Year (Fill in all that apply)

1	Trail Opening
0.5	Tread Repair
0.5	Drainage Cleanout
1	Logging Out
0.5	Brushing
0	Snow Trail Grooming
0.5	Condition Survey

TMO Form ASP - Side 1 Page 1 of 3

Figure 1.3 - Trail Management Objectives Form: Example

Trail Management Objectives (TMO) Part 2

Trail Use Strategies

Rev. Date: 11/1/2011

Managed Use

(Fill in all that apply.)

	Season From (mm/dd)	Season To (mm/dd)
☒ Hiker / Pedestrian	05/01	09/30
☒ Pack & Saddle	05/01	09/30
☐ Bicycle		
☐ Wheelchair		
☐ Motorcycle		
☐ All Terrain Vehicle (ATV)		
☐ _____		
☒ Cross-Country Ski	09/30	05/01
☐ Snowmobile		
☐ Dog Sled		
☐ Skijoring		
☐ _____		
☐ Watercraft: Non-Motorized		
☐ Watercraft: Motorized		

Prohibited Use

(Check if applicable.)

	From Date (mm/dd)	To Date (mm/dd)
☒ All Motorized Use		
(Or fill in all that apply.)		
☐ Hiker / Pedestrian		
☐ Pack & Saddle		
☒ Bicycle		
☒ Wheelchair		
☒ Motorcycle		
☒ All-Terrain Vehicle (ATV)		
☐ _____		
☐ Cross-Country Ski		
☒ Snowmobile		
☐ Dog Sled		
☐ Skijoring		
☐ _____		
☐ Watercraft: Non-Motorized		
☐ Watercraft: Motorized		

Other Use

(Optional: Check any that apply.)

	Accept	Discourage	Eliminate
☒ Hiker / Pedestrian	☒	☐	☐
☒ Pack & Saddle	☒	☐	☐
☐ Bicycle	☐	☐	☐
☐ Wheelchair	☐	☐	☐
☐ Motorcycle	☐	☐	☐
☐ All-Terrain Vehicle (ATV)	☐	☐	☐
☐ _____	☐	☐	☐
☒ Cross-Country Ski	☒	☐	☐
☐ Snowmobile	☐	☐	☐
☐ Dog Sled	☐	☐	☐
☐ Skijoring	☐	☐	☐
☐ _____	☐	☐	☐
☐ Watercraft: NonMotorized	☐	☐	☐
☐ Watercraft: Motorized	☐	☐	☐

Special Considerations

(Check any that apply. Provide specifics and reference information below.)

- ☐ Accessible per Current Agency Guidelines
- ☐ Mechanized Tools or Equipment Prohibited
- ☐ Threat., Endang. or Sens. Species (☐Plant /☐Wildlife)
- ☒ Cultural Resource Present
- ☐ Easement across Non-Park Land (☐Existing /☐Needed)
- ☐ Existing Permit or Agreement (☐Trail-Specific /☐Area)
- ☐ _____

Remarks / Reference Information

(Use continuation sheet if needed.)

Cultural resources under review. Access heavily used during the fall moose hunt in Ship Creek Valley. Trail needs to be built to allow horse crossing of the five streams so they do not use the bridges. Current trail location in unsustainable beyond the first bridge. New alignment will move trail up on west slope of valley bottom. Area has high level of spruce bark beetle kill. Used in winter for Arctic to Indian traverse.

Completed by: T. Crocket Title: Park Ranger I Date: 11/1/11

Approved by: M. Wedeking Title: Chief Ranger Date: 11/1/11

TMO Form - Side 2 Page 2 of 3

Rev. Date:
11/1/2011

Trail Name: Indian Valley Trail **Trail ID:**

Remarks / Reference Information (Continuation Sheet)

FIELD NOTES: Please describe work done and any changes needed in information database.

Trail Crew Work Notes:

2008 Season
-CSP crew 2 weeks
-SAGA crew 25 days
-Turnpike built
-First bridge replacement
-Four loads of gravel

2009 Season
-SAGA crew 10 days
-Two loads of gravel

TMO Form - Continuation

Page 3 of 3

Section 2: Trail Classification System

The following ***Trail Classification System*** is a close adaptation of the National Trail Classification System that has been formally adopted by the USFS, and can be referenced in USFS TRACS course material. Utilization of this system is an important step towards enhancing partnerships with organizations and agencies that border and partner with Alaska State Parks. This system will help develop resource management efficiencies by using consistent trail management terminology and standards. The *Trail Classification System* is similar to other systems used in the past; the scale of trail development is defined by a particular trail class that identifies applicable design parameters and provides management intent for what maintenance standards apply. This new system differs in that the design parameters for a particular class are further refined by the *trail type* and *designed use* of the trail. The new system allows for more thorough assessments of trail conditions, an expanded means to record and communicate intended design and management guidelines, and will provide better planning potential for trail management and maintenance.

The following is a brief description of how the *Trail Classification System* is organized, as well as ***Trail Class*** tables.

2.1 Trail Type

Trails are classified by three types (see below). Only one type may be used to describe a given trail or trail segment per use season. It is possible to classify a single trail under multiple trail types. For example, a particular trail may have specifications for terra type and different specifications for snow type. Trails can be in the same physical location but described differently for seasonal purposes.

The three standard trail types:

Terra Trail
Snow Trail
Water Trail

2.2 Trail Class

Trail classes are an inventory convention used to identify applicable Design Parameters.
Five trail classes ranging from *least developed* (Class 1) to *highly developed* (Class 5), however, some trail classes may not be applicable to a trail type (such as a Class 5 water trail).

Trail Class 1: Minimal / Undeveloped Trail

Trail Class 2: Simple / Minor Development Trail

Trail Class 3: Developed / Improved Trail

Trail Class 4: Highly Developed Trail

Trail Class 5: Fully Developed Trail

Park area managers should identify the applicable *trail class* for each state park trail or trail segment that most closely matches a trail's managed objective. The appropriate *trail class* should be determined at the trail-specific level and recorded in a TMO document / form (as shown in Section 1). There is a direct relationship between *trail class* and *managed use*; one cannot be determined without consideration of the other. Actively managed uses, user preferences, setting, protection of sensitive resources, and other management activities should be taken into account. *Trail classes* describe the typical attributes but exceptions may occur. All exceptions should be adequately described in a trail's TMO.

The General Criteria on the following pages define each trail class and are applicable to all system trails and trail segments.

2.3 Trail Management Classes

Table 2.1 – Trail Management Classes (Adapted from USFS TRACS Trail Classes.)

Trail Attributes	Trail Class 1 Minimal / Undeveloped Trail	Trail Class 2 Simple / Minor Development Trail	Trail Class 3 Developed / Improved Trail	Trail Class 4 Highly Developed Trail	Trail Class 5 Fully Developed Trail
General Criteria Physical Characteristics to be Applied to all State Park Trails					
Tread and Traffic Flow	◆ Tread intermittent and often indistinct ◆ May require route finding ◆ Native materials only	◆ Tread discernible and continuous, but narrow and rough ◆ Few or no allowances constructed for passing ◆ Native materials	◆ Tread obvious and continuous ◆ Width accommodates unhindered one-lane travel, occasional allowances constructed for passing ◆ Typically native materials	◆ Tread wide and relatively smooth with few irregularities ◆ Width may consistently accommodate two-lane travel ◆ Native or imported materials ◆ May be hardened	◆ Width generally accommodates two-lane and two-directional travel, or provides frequent passing turnouts ◆ Commonly hardened with asphalt or other imported material
Obstacles	◆ Obstacles common ◆ Narrow passages; brush, steep grades, rocks and logs present	◆ Obstacles occasionally present ◆ Blockages cleared to define route and protect resources ◆ Vegetation may encroach into trailway	◆ Obstacles infrequent ◆ Vegetation cleared outside of trailway	◆ Few or no obstacles exist ◆ Grades typically <12% ◆ Vegetation cleared outside of trailway	◆ No obstacles ◆ Grades typically <8%
Constructed Features and Trail Elements	◆ Minimal to non-existent ◆ Drainage is functional ◆ No constructed bridges or foot crossings	◆ Structures are of limited size, scale, and number ◆ Drainage functional ◆ Structures adequate to protect trail infrastructure and resources ◆ Primitive foot crossings and fords	◆ Trail structures (walls, steps, drainage, raised trail) may be common and substantial ◆ Trail bridges as needed for resource protection and appropriate access ◆ Generally native materials used	◆ Structures frequent and substantial ◆ Substantial trail bridges are appropriate at water crossings ◆ Trailside amenities may be present	◆ Structures frequent or continuous; may include curbs, handrails, trailside amenities, and boardwalks ◆ Drainage structures frequent; may include culverts and road-like designs
Signs	◆ Minimum required ◆ Generally limited to regulation and resource protection ◆ No destination signs present	◆ Minimum required for basic direction ◆ Generally limited to regulation and resource protection ◆ Typically very few or no destination signs present	◆ Regulation, resource protection, user reassurance ◆ Directional signs at junctions, or when confusion is likely ◆ Informational and interpretive signs may be present	◆ Wide variety of signs likely present ◆ Informational signs likely ◆ Interpretive signs possible	◆ Wide variety of signage is present ◆ Information and interpretive signs likely

Trail Attributes	**Trail Class 1** Minimal / Undeveloped Trail	**Trail Class 2** Simple / Minor Development Trail	**Trail Class 3** Developed / Improved Trail	**Trail Class 4** Highly Developed Trail	**Trail Class 5** Fully Developed Trail
General Criteria Physical Characteristics to be Applied to all State Park Trails					
Typical Recreation Environs and Experience	◆ Natural, unmodified ◆ Primitive setting	◆ Natural, essentially unmodified ◆ Primitive to Semi-Primitive	◆ Natural, primarily unmodified ◆ Semi-primitive to roaded natural setting ◆ Transition	◆ May be modified ◆ Typically roaded natural setting ◆ Transition	◆ Can be highly modified ◆ Typically rural to urban setting ◆ Commonly associated with Visitor Centers or high-use recreation sites
Trail Management Typically managed to accommodate:	◆ Low level use ◆ Highly skilled users comfortable off trail ◆ Users w/ high level orienteering skills ◆ Some travel modes and ability levels may be impractical/impossible ◆ Water trail users require high level of navigation/orientation and paddling skills	◆ Low to moderate use levels ◆ Mid-to-highly skilled users, capable of traveling over awkward conditions/obstacles ◆ Users w/ moderate orienteering skill ◆ Trail suitable for many user types but challenging and involves advanced skills ◆ Water trails: moderate to high level of navigation/orientation and paddling/piloting skills required	◆ Moderate to heavy use ◆ Users w/ intermediate skill leveland experience ◆ Users w/ minimal orienteering skills ◆ Moderately easy travel by managed use types ◆ Random potential for accessible use ◆ Water trails: basic to moderate navigation and paddling/piloting skills required	◆ Very heavy use ◆ Users w/ minimal skills and experience ◆ Users with minimal to no orienteering skills ◆ Easy/comfortable travel by managed use types ◆ Has the potential to be made handicap accessible ◆ Water trails: basic to moderate navigation and paddling/piloting skills required	◆ Intensive use ◆ Users w/ limited trail skills and experience ◆ Trail typically meets agency requirements for accessibility

Trail Attributes	Trail Class 1 Minimal / Undeveloped Trail	Trail Class 2 Simple / Minor Development Trail	Trail Class 3 Developed / Improved Trail	Trail Class 4 Highly Developed Trail	Trail Class 5 Fully Developed Trail
General Criteria Physical Characteristics to be Applied to all State Park Trails					
Maintenance Indicators and Intensity	◆ Resource protection or safety commensurate with targeted recreational experience ◆ Infrequent or no scheduled maintenance, usually in response to reports of unusual resource problems requiring repair ◆ Typically not managed for Pack and Saddle and Motorized Trails	◆ Resource protection or safety commensurate with targeted recreational experience ◆ Maintenance scheduled to preserve trail facility and route location or in response to reports of unusual resource problems	◆ User convenience ◆ Resource protection or safety commensurate with targeted recreational experience ◆ Trail cleared to make available for use early in use season and to preserve trail integrity ◆ Maintenance typically in response to trail or resource damage or significant obstacles to managed use type and experience level	◆ User comfort and ease ◆ Resource protection or safety commensurate with targeted recreational experience ◆ Trail cleared to make available for use at earliest opportunity in use season ◆ Maintenance typically performed at least annually	◆ User comfort and ease ◆ Targeted high level of accessibility to key recreational opportunities ◆ Safety commensurate with targeted recreational experience ◆ Maintenance performed at least annually or as needed to meet posted conditions, major damage or safety concerns typically corrected or posted within 24 hours of notice ◆ Not managed for Pack and Saddle stock, or motorized use
Additional Criteria	◆ Typically not managed for Pack and Saddle and Motorized trails.				◆ Not managed for Pack and Saddle stock, watercraft, or motorized use.

2.3.1 Trail Management Classes: Examples

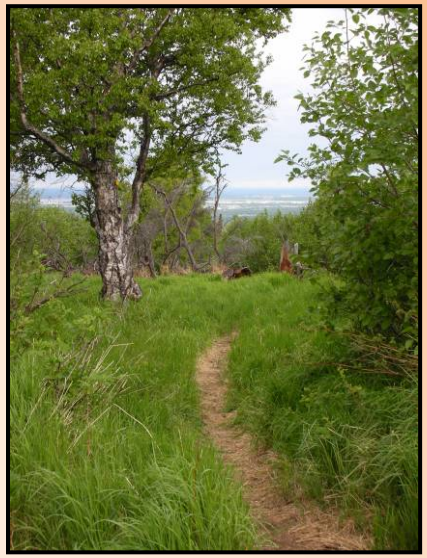
Figure 2.1 – Trail Management Classes: Examples

Trail Class 1

- Low level use
- Highly skilled users, comfortable off trail with high degree of orienteering skill
- Some travel modes may be impractical or impossible

Trail Class 2

- Low to moderate use levels
- Mid-to-highly skilled users, capable of traveling over awkward conditions/obstacles
- Trail suitable for many types but challenging, involving advanced skills



Trail Class 3

- Moderate to heavy use
- Users with intermediate skill level and experience
- Moderately easy travel by managed use types

Trail Class 4

- Very heavy use
- Users with minimal skills and experience
- Easy/comfortable travel by managed use types

Trail Class 5

- Intensive use
- Users with limited trails and skills and experience
- Trail typically meets agency requirements for accessibility

Section 3: Trail Design Parameters

The following ***Trail Design Parameters*** are a close adaptation of the Trail Design Parameters that have been formally adopted by the USFS, and can be referenced in USFS TRACS course material. Trail design parameters provide guidance for the assessment, survey, design, construction, repair, and maintenance of trails. While the five trail classes apply, the specific design parameters vary under each trail class depending on the designed use. Site-specific circumstances may demand some exceptions or variances to the Design Parameters based on trail-specific conditions, topography, or other factors, provided that the deviations are consistent with the general intent of the applicable trail class. Any exception to a design parameter or trail classification should be adequately documented in a trail's TMO. All drawings in Section 3 are original artwork by Ted E. Kincaid (2010-2011).

Table 3.1 - Hiker / Pedestrian Terra Trail Design Parameters

Designed Use Hiker/Pedestrian: Terra Trail		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Tread Width	**Single Lane**	0” – 12”	6” – 18”	18” – 36”	24” – 60”	36” – 72”
	Double Lane	36”	36”	36” – 60”	48” – 72”	72” – 120”
	Structures (Minimum Width)	18”	18”	18”	36”	36”
Design Surface	**Type**	Native, ungraded May be continuously rough	Native, limited grading May be continuously rough	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough	Native with improved sections of borrow or imported material, and routine grading Minor roughness	Likely imported material, and routine grading Uniform, firm, and stable
	Protrusions	≤ 24” Likely common and continuous	≤ 6” May be common and continuous	≤ 3” May be common, not continuous	≤ 3 ” Uncommon, not continuous	No protrusions
	Obstacles (Maximum Height)	24”	14”	10”	8”	No obstacles
Design Grade	**Target Grade**	5% – 25%	5% – 18%	3% – 12%	2% – 10%	2% – 5%
	Short Pitch Maximum	40%	35%	25%	15%	5% – 12%
	Maximum Pitch Density	20% – 40% of trail	20% – 30% of trail	10% – 20% of trail	5% – 20% of trail	0% – 5% of trail
Design Cross Slope	**Target Cross Slope**	Natural side slope	5% – 20%	5% – 10%	3% – 7%	2% – 3% (or crowned)
	Maximum Cross Slope	Natural side slope	25%	15%	10%	3%
Design Clearing	**Height**	6’	6’ – 7’	7’ – 8’	8’ – 10’	8’ – 10’
	Width	≥ 24” Some vegetation may encroach into clearing area	24” – 48” Some light vegetation may encroach into clearing area	36” – 60”	48” – 72”	60” – 72”
	Shoulder Clearance	3” – 6”	6” – 12”	12” – 18”	12” – 18”	12” – 24”

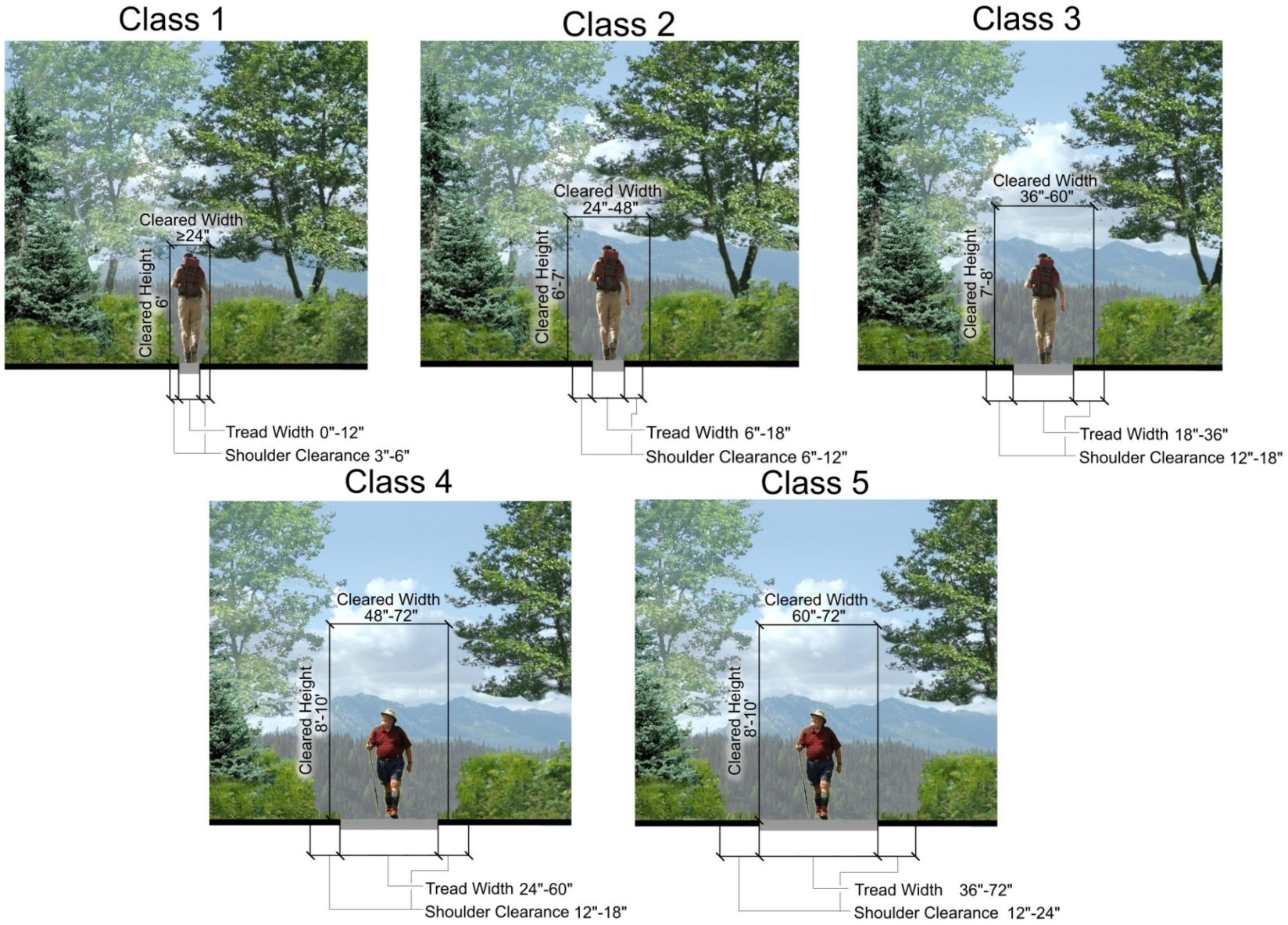


Figure 3.1 - Hiker / Pedestrian Terra Trail Design Parameters

Table 3.2 - Pack and Saddle Terra Trail Design Parameters

Designed Use **Pack and Saddle: Terra Trail**		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**Single Lane**	Typically not designed or actively managed for equestrians, although use may be allowed	12” – 24” May be up to 48” along steep side slopes 48” – 60” or greater along precipices	18” – 48” 48” – 60” or greater along precipices	24” – 96” 48” – 60” or greater along precipices	Typically not designed or actively managed for equestrians, although use may be allowed
	Double Lane		60”	60” – 84”	84” – 120”	
	Structures (Minimum Width)		Other than bridges: 36” Bridges without handrails: 60” Bridges with handrails: 84” clear width	Other than bridges: 36” Bridges without handrails: 60” Bridges with handrails: 84” clear width	Other than bridges: 36” Bridges without handrails: 60” Bridges with handrails: 84” clear width	
Design Surface	**Type**		Native, with limited grading May be frequently rough	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough	Native, with improved sections of borrow or imported material and routine grading Minor roughness	
	Protrusions		≤ 6” May be common and continuous	≤ 3” May be common, not continuous	≤ 3” Uncommon, not continuous	
	Obstacles (Maximum Height)		12”	6”	3”	
Design Grade	**Target Grade**		5% – 20%	3% – 12%	2% – 10%	
	Short Pitch Maximum		30%	20%	15%	
	Maximum Pitch Density		15% – 20% of trail	5% – 15% of trail	5% – 10% of trail	
Design Clearing	**Height**		8’ – 10’	10’	10’ – 12’	
	Width		72” Some light vegetation may encroach into clearing area	72” – 96”	96”	
	Shoulder Clearance		6” – 12” Pack clearance: 36” x 36”	12” – 18” Pack clearance: 36” x 36”	12” – 18” Pack clearance: 36” x 36”	
Design Turn	**Radius**		4’ – 5’	5’ – 8’	6’ – 10’	

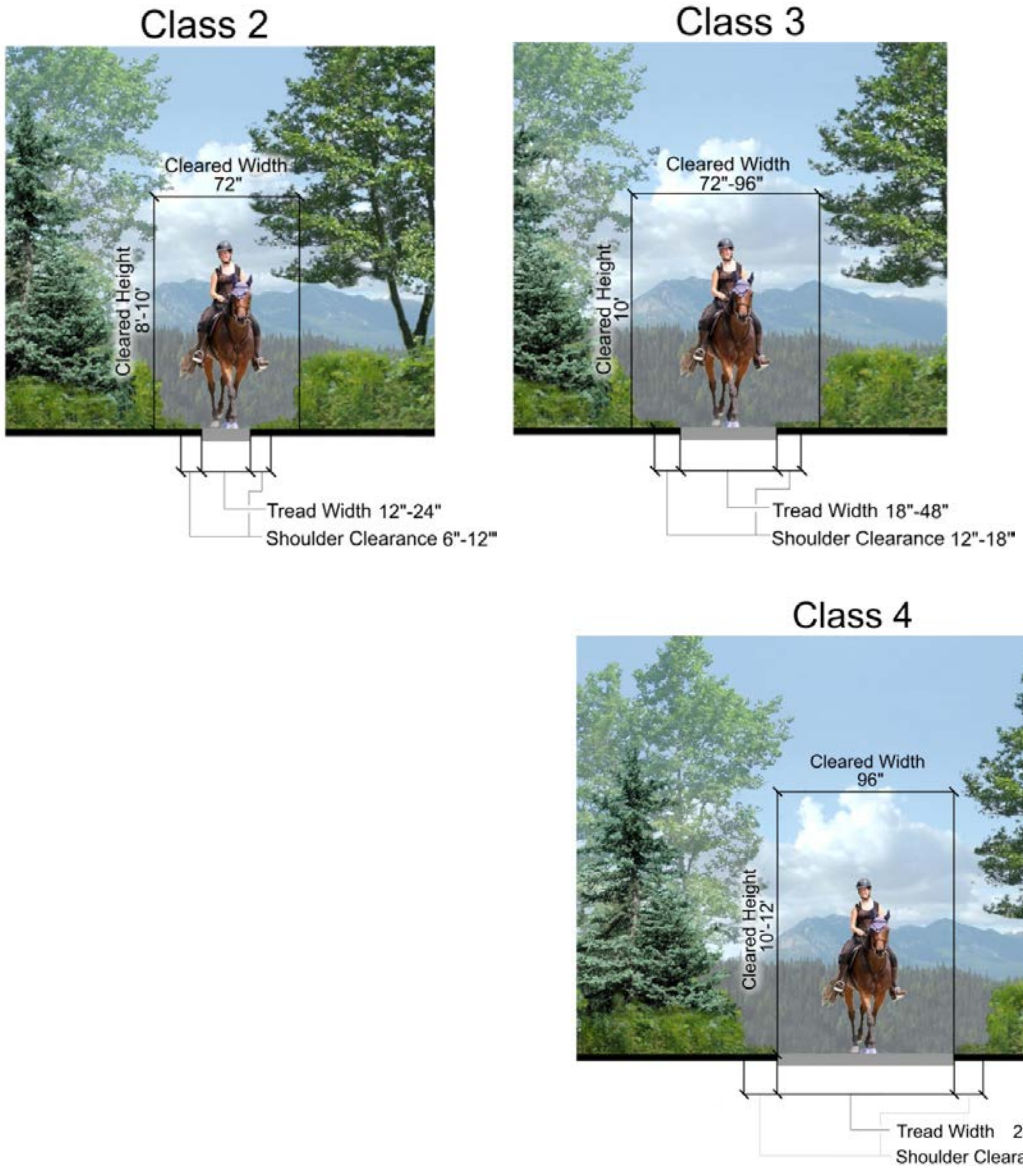


Figure 3.2 - Pack and Saddle Terra Trail Design Parameters

Table 3.3 - Bicycle Terra Trail Design Parameters

Designed Use **BICYCLE: Terra Trail**		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Tread Width	**Single Lane**	6" – 12"	12" – 24"	18" – 36"	24" – 48"	36" – 60"
	Double Lane	36" – 48"	36" – 48"	36" – 48"	48" – 84"	72" – 120"
	Structures (Minimum Width)	18"	18"	36"	48"	60"
Design Surface	**Type**	Native, ungraded May be continuously rough Sections of soft or unstable tread on grades < 5% may be common and continuous	Native, with limited grading May be continuously rough Sections of soft or unstable tread on grades < 5% may be common	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough Sections of soft or unstable tread on grades < 5% may be present, but not common	Native, with improved sections of borrow or imported materials and routine grading Stable, with minor roughness	Likely imported material and routine grading Uniform, firm, and stable
	Protrusions	≤ 24" Likely common and continuous	≤ 6" May be common and continuous	≤ 3" May be common, but not continuous	≤ 3" Uncommon and not continuous	No protrusions
	Obstacles (Maximum Height)	24"	12"	10"	8"	No obstacles
Design Grade	**Target Grade**	5% – 20%	5% – 12%	3% – 10%	2% – 8%	2% – 5%
	Short Pitch Maximum	30% 50% on downhill segments only	25% 35% on downhill segments only	15%	10%	8%
	Maximum Pitch Density	20% – 30% of trail	10% – 30% of trail	10% – 20% of trail	5% – 10% of trail	0% – 5% of trail
Design Cross Slope	**Target Cross Slope**	5% – 10%	5% – 8%	3% – 8%	3% – 5%	2% – 3%
	Maximum Cross Slope	10%	10%	8%	5%	5%
Design Clearing	**Height**	6'	6' – 8'	8'	8' - 9'	8' - 9'
	Width	24" – 36" Some vegetation may encroach into clearing area	36" – 48" Some light vegetation may encroach into clearing area	60" – 72"	72" – 96"	72" – 96"
	Shoulder Clearance	0' – 12"	6" – 12"	6" – 12"	6" – 18"	12" – 18"
Design Turn	**Radius**	2' – 3'	3' – 6'	4' – 8'	8' – 10'	8' - 12'

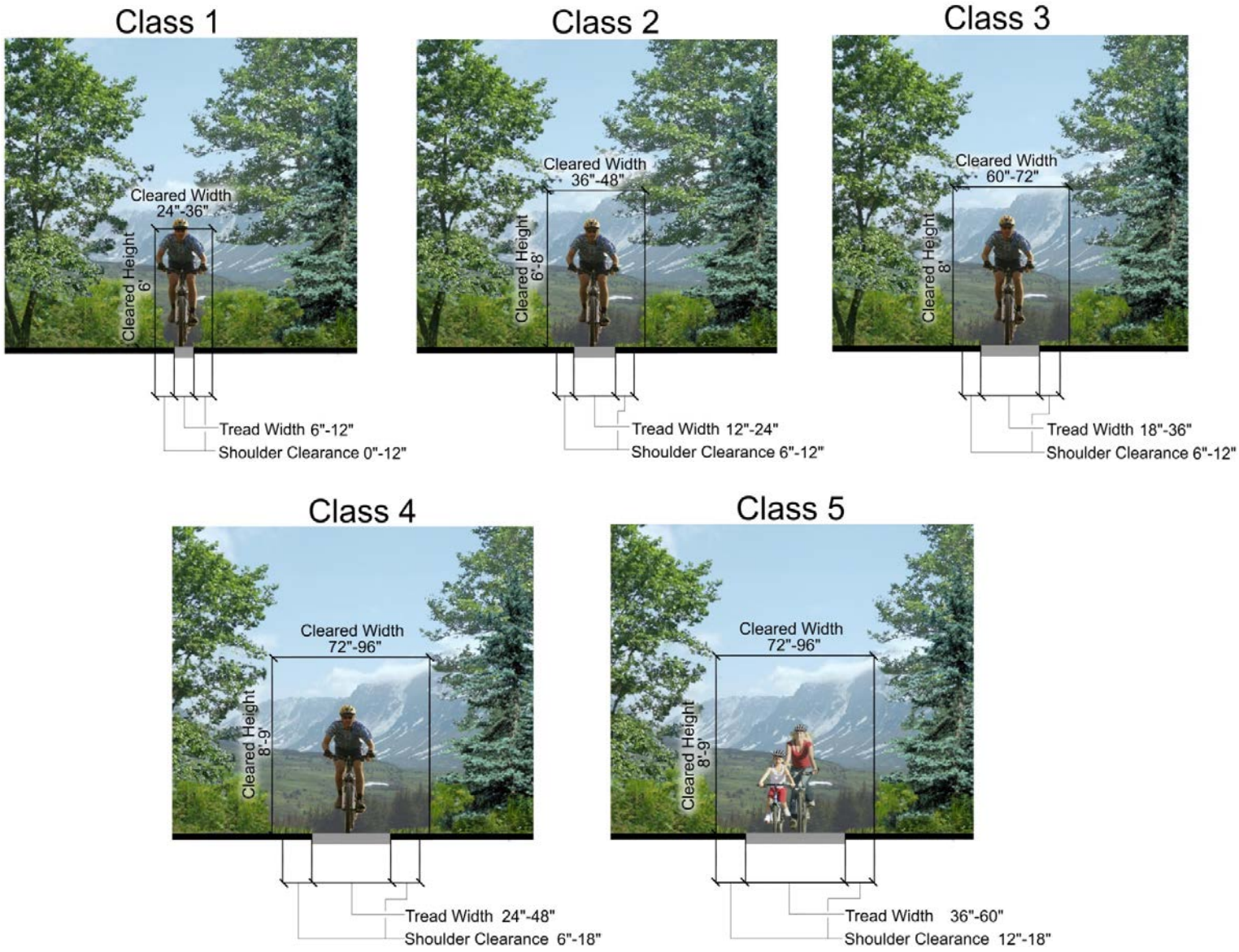


Figure 3.3 - Bicycle Terra Trail Design Parameters

Table 3.4 - All-Terrain Vehicle (ATV) Terra Trail Design Parameters

Designed Use **ATV: Terra Trail**		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**Single Lane**	Typically not designed or actively managed for ATVs, although use may be allowed	48” – 60”	60”	60” – 72”	Typically not designed or actively managed for ATVs, although use may be allowed
	Double Lane		96”	96” – 108”	96” – 120”	
	Structures (Minimum Width)		60”	60”	60”	
Design Surface	**Type**		Native, with limited grading May be continuously rough Sections of soft or unstable tread on grades < 5% may be common and continuous	Native, with some on-site borrow or imported material where needed for stabilization and occasional grading Intermittently rough Sections of soft or unstable tread on grades < 5% may be present	Native, with imported materials for tread stabilization likely and routine grading Minor roughness Sections of soft tread uncommon	
	Protrusions		≤ 6” May be common and continuous	≤ 3” May be common, but not continuous	≤ 3” Uncommon and not continuous	
	Obstacles (Maximum Height)		12” May be common or placed for increased challenge	6” May be common and left for increased challenge	3” Uncommon	
Design Grade	**Target Grade**		10% – 25%	5% – 15%	3% – 10%	
	Short Pitch Maximum		35%	25%	15%	
	Maximum Pitch Density		20% – 40% of trail	15% – 30% of trail	10% – 20% of trail	
Design Cross Slope	**Target Cross Slope**		5% – 10%	3% – 8%	3% – 5%	
	Maximum Cross Slope		15%	10%	8%	
Design Clearing	**Height**		6’ – 7’	6’ – 8’	8’ – 10’	
	Width (On steep side hills, increase clearing on uphill side by 6” – 12”)		60” Some light vegetation may encroach into clearing area	60” – 72”	72” - 96”	
	Shoulder Clearance		0” – 6”	6” – 12”	12” – 18”	
Design Turn	**Radius**		6’ – 8’	8’ – 10’	8’ – 12’	

Figure 3.4 - All-Terrain Vehicle (ATV) Terra Trail Design Parameters

Table 3.5 - Snowmobile Snow Trail Design Parameters

Designed Use **Snowmobile: Snow Trail**		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**Single Lane**	Typically not designed or actively managed for snowmobiles, although use may be allowed	4’ – 6’ Typically not groomed	6’ – 8’ Or width of grooming equipment. On turns with tight radius, increase groomed width to ≥ 10’	8’ – 10’ Or width of grooming equipment. On turns with tight radius, increase groomed width to ≥ 12’	Typically not designed or actively managed for snowmobiles, although use may be allowed
	Double Lane		10’ Typically not groomed	10’ – 12’	12’ – 20’	
	Structures (Minimum Width)		6’	12’	18’	
Design Surface	**Type**		Generally no machine grooming Commonly rough and bumpy	May receive occasional machine grooming for snow compaction and conditioning Frequently rough and bumpy	Regular machine grooming for snow compaction and conditioning Commonly smooth	
	Protrusions		No protrusions	No protrusions	No protrusions	
	Obstacles (Maximum Height)		12” Uncommon	6” Uncommon (no obstacles if machine groomed)	No obstacles	
Design Grade	**Target Grade**		0% – 12%	0% – 10%	0% – 8%	
	Short Pitch Maximum		35%	25%	20%	
	Maximum Pitch Density		15% – 30% of trail	10% – 20% of trail	5% – 10% of trail	
Design Cross Slope	**Target Cross Slope**		0% – 10%	0% – 5%	0%	
	Maximum Cross Slope		15%	10%	5%	
Design Clearing	**Height** (Above normal maximum snow level)		6’	6’ – 8’ Provide sufficient clearance for grooming equipment	8’ – 12’ Provide sufficient clearance for grooming equipment	
	Width		6’ – 12’ Some light vegetation may encroach into clearing area	8’ – 14’ Light vegetation may encroach into clearing area	10’ – 22’ Widen clearing at turns or if increased sight distance needed	
	Shoulder Clearance		6” – 12”	12” – 18”	12” – 24”	
Design Turn	**Radius**		8’ – 10’	15’ – 20’ Or to accommodate grooming equipment	25’ – 50’	

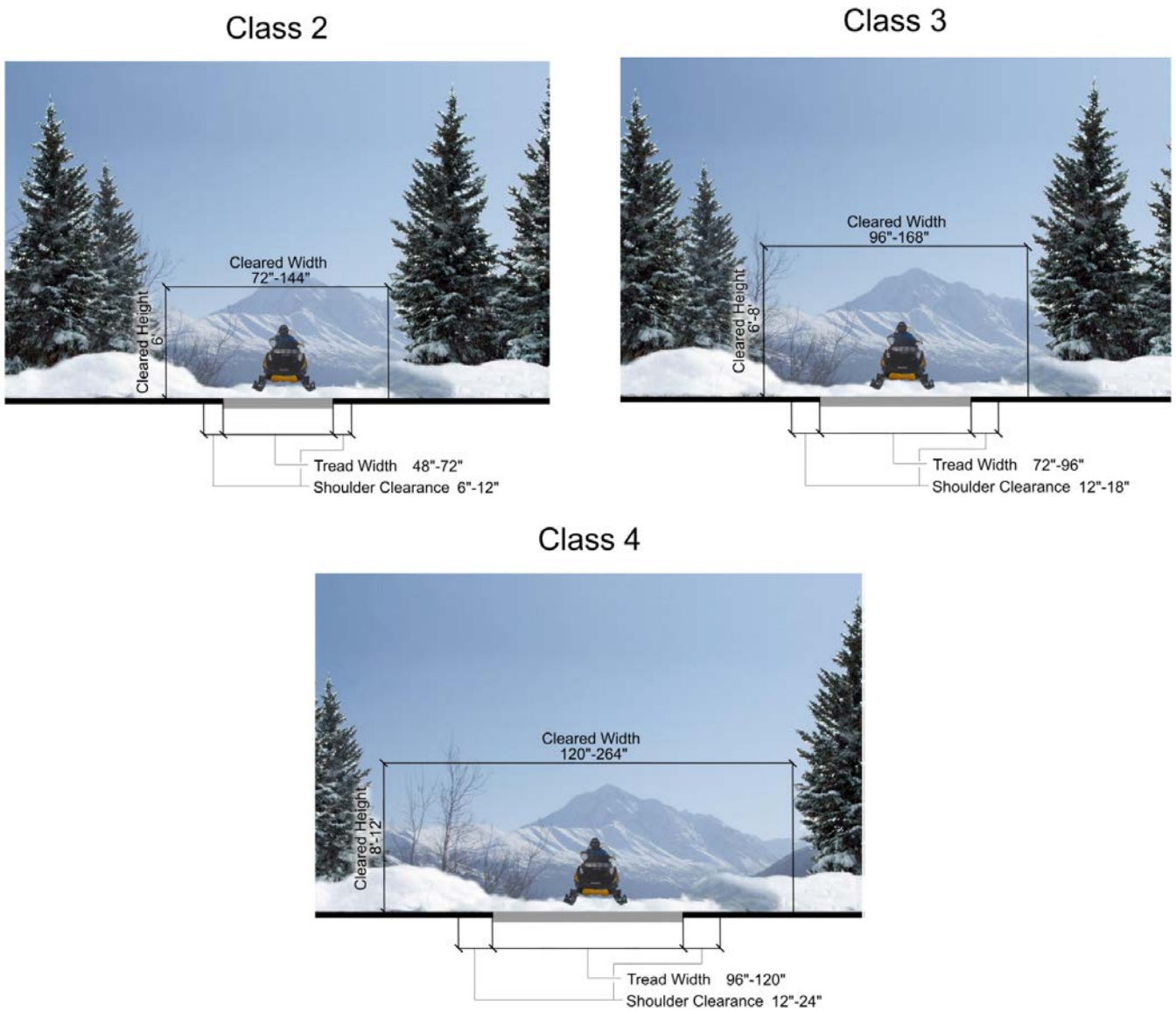


Figure 3.5 - Snowmobile Snow Trail Design Parameters

Table 3.6 - Cross-Country Ski Snow Trail Design Parameters

Designed Use (Diagonal / Classic ski) **Cross-Country Ski: Snow Trail**		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Groomed Width	**Single Lane**	Typically not designed or actively managed for cross-country skiing, although use may be allowed	2’ – 4’ Typically not groomed	6’ – 8’ Or width of grooming equipment	8’– 10” Or width of grooming equipment	Typically not designed or actively managed for cross-country skiing, although use may be allowed
	Double Lane		6’ – 8’	8’ – 12’	12’ – 16’	
	Structures (Minimum Width)		36”	36”	36”	
Design Grooming and Surface	**Type**		Generally no machine grooming	May receive occasional machine grooming for snow compaction and track setting	Regular machine grooming for snow compaction and track setting	
	Protrusions		No protrusions	No protrusions	No protrusions	
	Obstacles (Maximum Height)		12” Uncommon	8” Uncommon (no obstacles if machine groomed)	No obstacles	
Design Grade	**Target Grade**		5% – 15%	2% – 10%	0% – 8%	
	Short Pitch Maximum		25%	20%	12%	
	Maximum Pitch Density		10% – 20% of trail	5% – 15% of trail	0% – 10% of trail	
Design Cross Slope	**Target Cross Slope**		0% – 10%	0% – 5%	0% – 5%	
	Maximum Cross Slope (For up to 50’)		20%	15%	10%	
Design Clearing	**Height** (Above normal maximum snow level)		6’ – 8’	8’ Or height of grooming equipment	8’ – 10’	
	Width		24” – 60” Light vegetation may encroach into clearing area	72” – 20”’ Light vegetation may encroach into clearing area	96”’ – 168” Widen clearing at turns or if increased sight distance needed	
	Shoulder Clearance		0” – 6”	0” - 12”	0” – 24”	
Design Turn	**Radius**		8’ – 10’	15’ – 20’ Or to accommodate grooming equipment	≥ 25’	

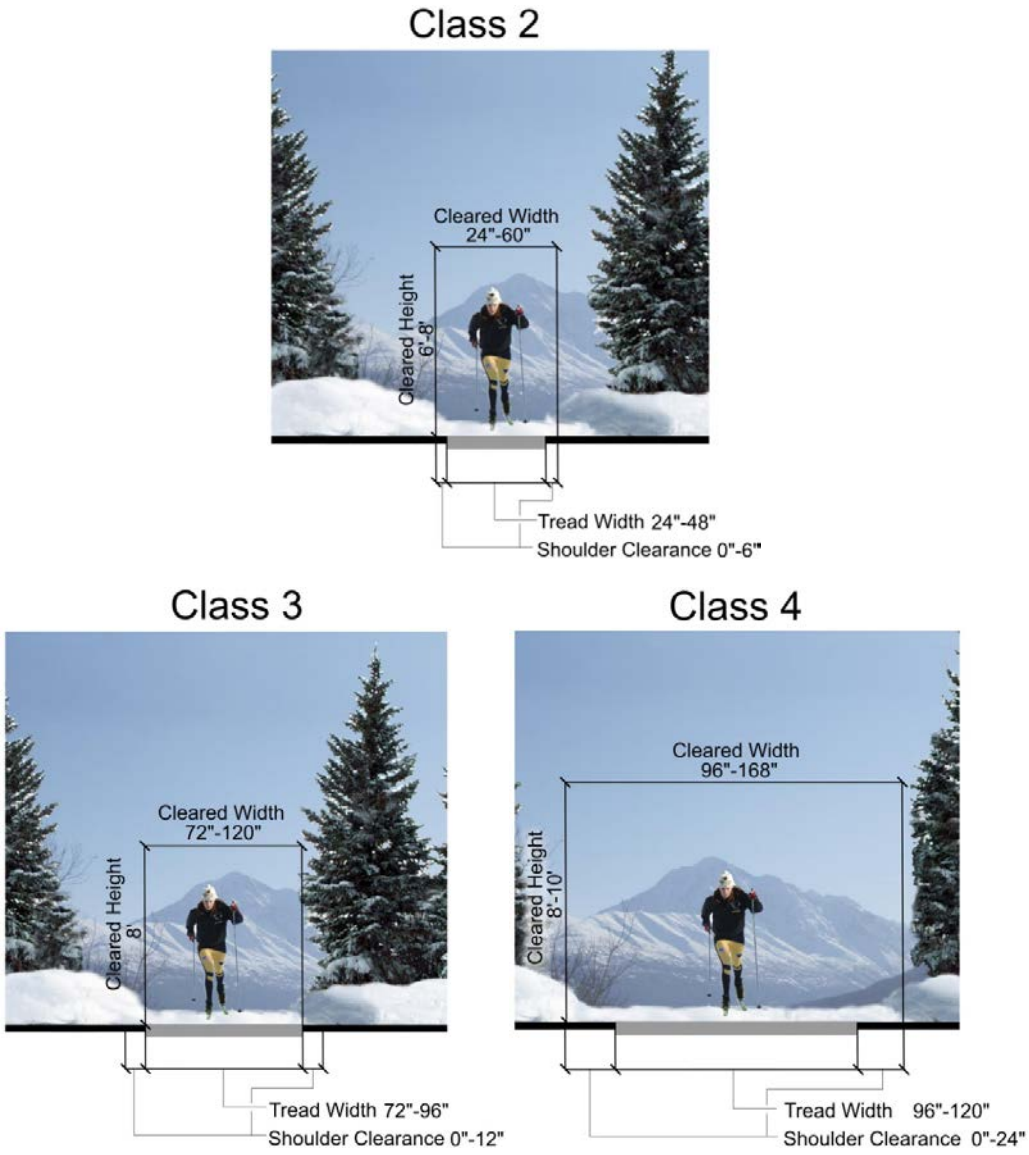


Figure 3.6 - Cross-Country Ski Snow Trail Design Parameters

Table 3.7 - Nordic / Skate Ski Snow Trail Design Parameters

Designed Use **Nordic / Skate Ski: Snow Trail**		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Groomed Width	**Single Lane**	Typically not designed or actively managed for skate skiing, although use may be allowed	Typically not designed or actively managed for skate skiing, although use may be allowed	6' – 8' Or width of grooming equipment	8'– 12' Or width of grooming equipment	12'-16' Or width of grooming equipment
	Double Lane[1]			8' – 12'	12' – 16'	14'-24'
	Structures (Minimum Width)			36"	36"	36"
Design Grooming and Surface	**Type**			May receive occasional machine grooming for snow compaction and track setting	Smooth compaction using implements designed for creating skate lanes.	Smooth compaction using implements designed for creating skate lanes.
	Protrusions			No protrusions	No protrusions	No protrusions
	Obstacles (Maximum Height)			8" Uncommon (no obstacles if machine groomed)	No obstacles	No obstacles
Design Grade	**Target Grade**			2% – 10%	0% – 8%	0% – 6%
	Short Pitch Maximum			20%	20%	20%
	Maximum Pitch Density			5% – 15% of trail	5%- 10% of trail	5-8% of trail
Design Cross Slope	**Target Cross Slope**			0% – 5%	0% – 5%	0% – 5%
	Maximum Cross Slope (For up to 50')			15%	12% Minimum cross-slope (crowned or one side) should be 2% to promote drainage	10% Minimum cross-slope (crowned or one side) should be 2% to promote drainage
Design Clearing	**Height** (Above normal maximum snow level)			8' Or height of grooming equipment	8' – 10' Or height of grooming equipment	At least 10' Or height of grooming equipment
	Width			6' – 14' Light vegetation may encroach into clearing area	8' – 18' Widen clearing at turns or if increased sight distance needed	8' – 26' Widen clearing at turns or if increased sight distance needed
	Shoulder Clearance			0" - 12"	0" – 24"	0" – 24"
Design Turn	**Radius**			15' – 20' Or to accommodate grooming equipment	≥ 25' Or to accommodate grooming equipment	25' - 30' Or to accommodate grooming equipment

[1] Double lane may accommodate a combination of diagonal and skate ski lanes with room to pass.

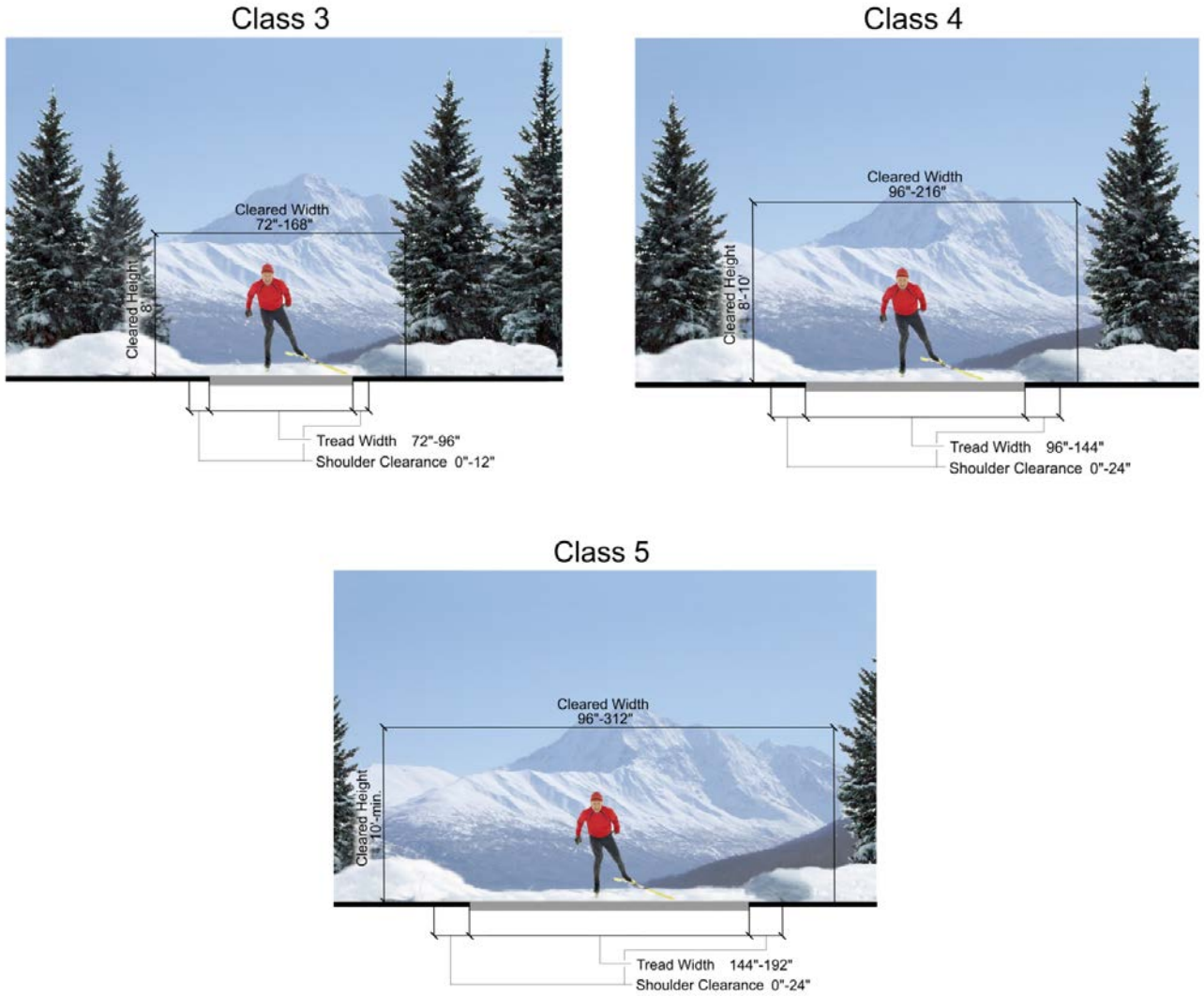


Figure 3.7 - Nordic / Skate Ski Snow Trail Design Parameters

Table 3.8 - Sled Dog Snow Trail Design Parameters

Designed Use **Dog Sled: Snow Trail**		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Groomed Width*	**Single Lane**	N/A not designed or managed for dog sleds as primary user.	3’- 4’. If groomed, width of grooming equipment.	6’- 8’ (or minimum width of grooming equipment).	8’ -10’, but typically managed to accommodate two-way passage.	N/A not designed or managed for dog sleds as primary user.
	Double Lane		Typically not designed for two-lane travel. Employ 6’-8’ passing areas in steeper sections.	>8’ (or minimum width of grooming equipment) and/or accommodate with passing areas 8’-12’ wide.	12’-14’	
Design Surface	**Type**		Coarse compaction. Occasional or no grooming (may be ski-packed). Snowmobile packing is sufficient. Track layer is optional.	Groomed or compacted using implements and/or tracklayer when packed surface is snow-covered, drifted, melted, or skied out.	Well-groomed with tiller and/or other implements. Groomed frequently, and when groomed surface becomes degraded or buried.	
	Obstacles (Max. Height) Caused by use, lack of grooming, melt or surface/subsurface protrusions)		Dips, bumps, or ruts to 12” common and may be tightly spaced. Surface obstacles may occasionally require off-trail bypass.	Generally smooth, dips bumps, or ruts to 8” uncommon and widely spaced. Surface obstructions not present.	Consistently smooth. Small, rolling bumps, dips and rises. Surface obstructions not present.	
Design Grade	**Target Grade** (> 90% of trail)		< 15%	0% – 10%	0% – 8%	
	Short Pitch Maximum (Up to 200’ lengths)		25%	20%	12%	
	Maximum Pitch Density		< 10% of trail	< 5% of trail	< 5% of trail	
Design Cross Slope	**Target Cross Slope**		< 10%	< 5%	< 5%	
	Maximum Cross Slope		15%	10%	5%	
Design Clearing	**Height** (Above normal maximum snow level)		6’-8’ or height of grooming machinery, if used.	> 8’ or height of grooming machinery	10’	
	Width		4’-6’ (or minimum width of grooming equipment, if larger). Light vegetation may encroach into clearing area.	>1’outside of groomed edge. Light vegetation may encroach slightly into clearing area.	>2’ outside of groomed edge. Widen clearing at turns or if increased sight distance is needed.	
Design Turns	**Radius** **(Use climbing turn versus switchbacks)**		8’-10’ if Cat-groomed. OR; minimum based on turning limits of grooming machine.	15’ – 20’ (Provide sufficient radius for grooming equipment).	> 25’	

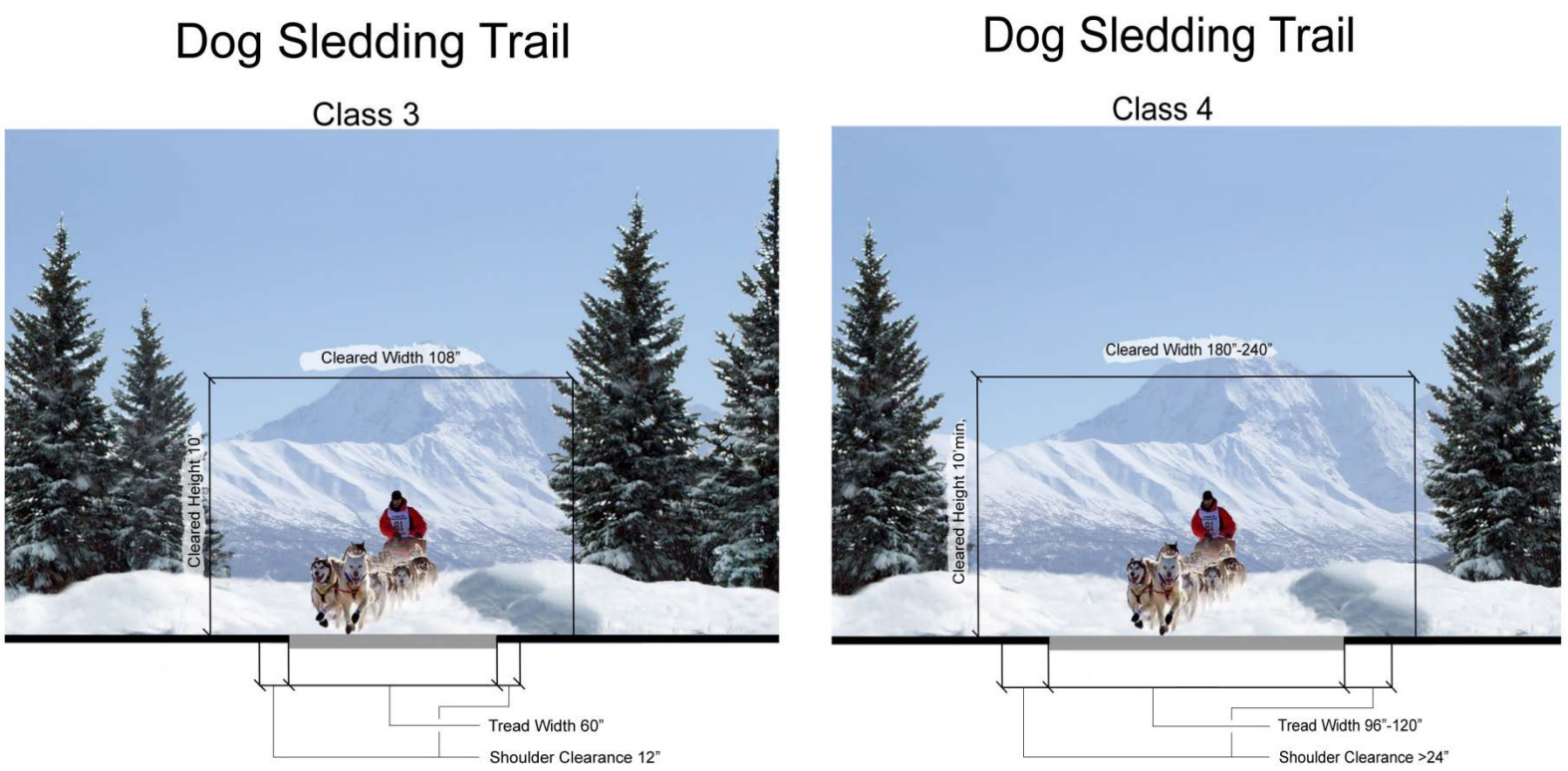


Figure 3.7 – Sled Dog Snow Trail Design Parameters

Table 3.9 - Non-Motorized Watercraft Water Trail Design Parameters

Designed Use **Non-Motorized Watercraft: Water Trail**		**Trail Class 1**	**Trail Class 2**	**Trail Class 3**	**Trail Class 4**	**Trail Class 5**
Design Tread Width	**Structures**	Water route shown on maps and used to access other trails or portages, but with no trail structures, facilities, signs, or recurring maintenance needs along route. Signs and/or parking facilities at initial access points only and likely associated with other trails or sites.	Few markers or route designators. Low profile structures or facilities occasionally present; primarily to reduce beach and bank impacts. Structures typically consist of native material hardening of portage/water entry points. Signs and/or parking facilities at initial access points only and likely associated with other trails or sites.	Buoys or markers possible to identify route Typically, facilities provide for improved access and to reduce beach and bank impacts. Well-developed parking and launch facilities at primary access points, but facilities and structures rare along the trail. Interpretive and informational displays typically present at primary access points	Buoys or markers are high profile and may be inter-visible and or route is readily followed. Highly developed launch facilities, docks, and amenities typically proved for user convenience. Well-marked approaches to facilities and portages. Interpretative displays, maps, information kiosks and signs typically present at access points and along route	Typically not designed or actively managed for watercraft, although use may be allowed
Design Surface	**Protrusions**	May be common and continuous	May be common and continuous	May be common, but not continuous	Uncommon and not continuous	
	Obstacles	May be common or placed for increased challenge	May be common or placed for increased challenge	May be common and left for increased challenge	Uncommon	
Design Clearing		In densely vegetated areas, users will commonly need to lift vessels over logs, shoals, or matted vegetation.	Path is typically narrow, shallow, and may occasionally require user to lift over obstacles or break path through some vegetation and duck under overhanging branches	Path is typically cleared wide enough for ready passage and maneuvering of at least one vessel, and usually two-way vessel passage, with only occasional low overhanging vegetation	Path is consistently cleared wide enough for unhindered, easy passage of two or more vessels.	

* For Portage sections of Water Trails see Figures 4.0, 4.1, 4.2. Water Trail design parameters are given primarily to provide guidance in applying the appropriate Trail Class. Additional design parameters should be developed by the resource manager for areas with extensive portages requiring maintenance and attention.

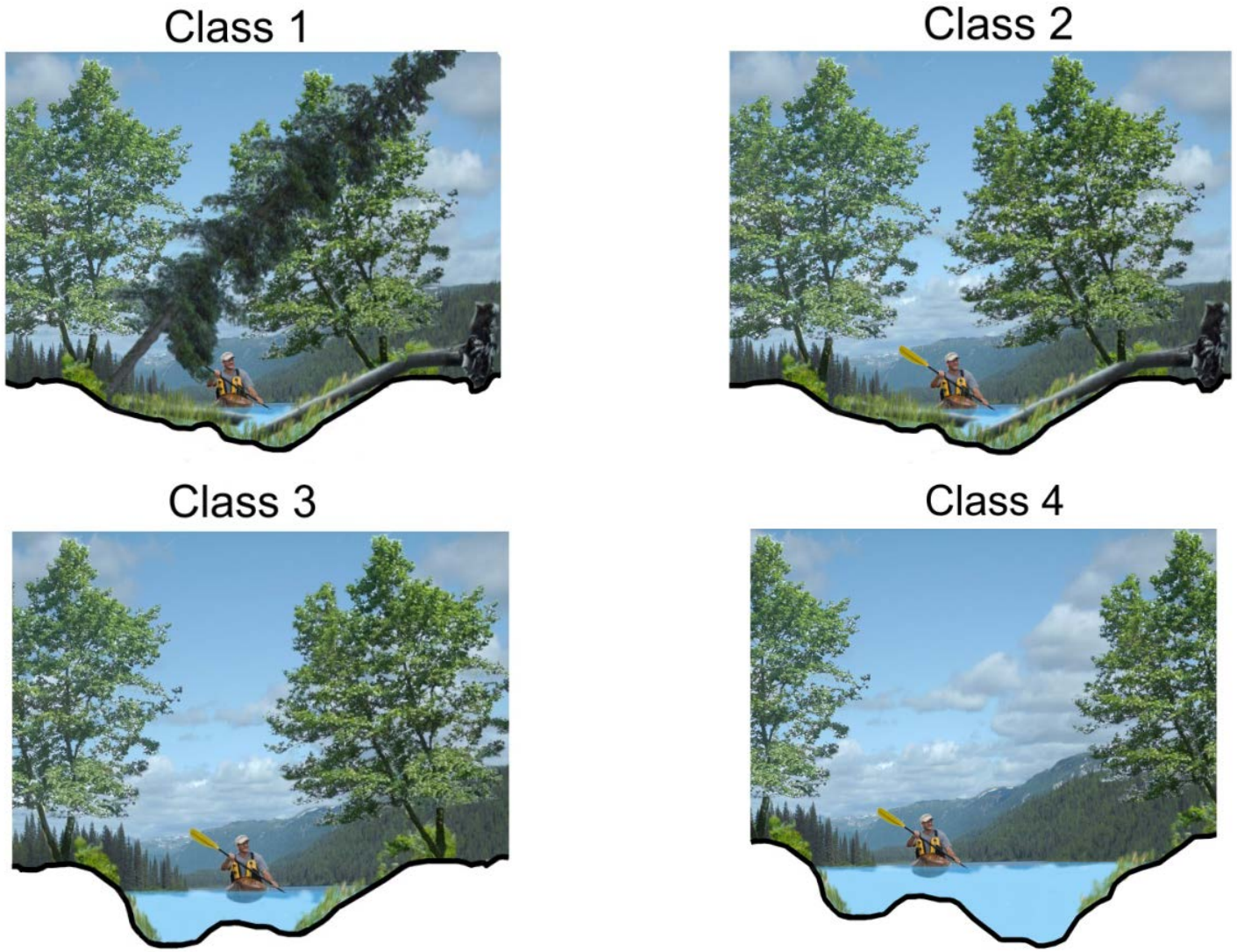
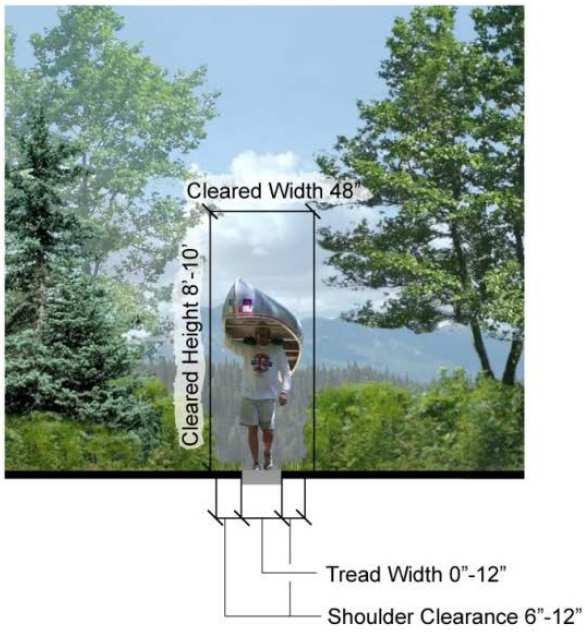


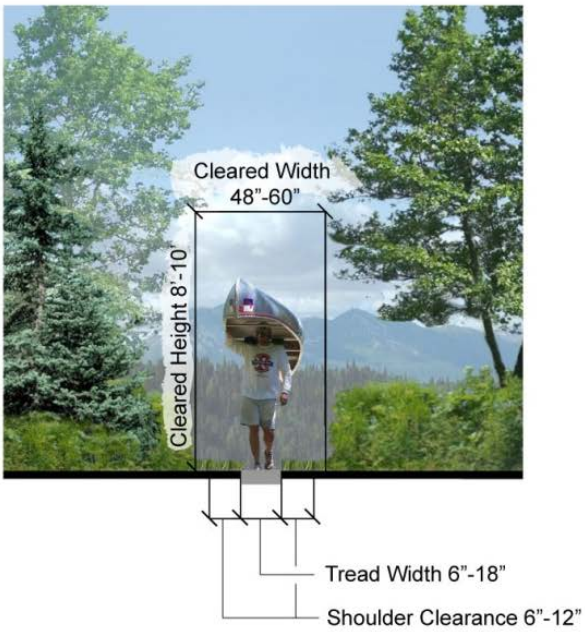
Figure 3.9 - Non-Motorized Watercraft Water Trail Design Parameters

Canoe Portage Trail

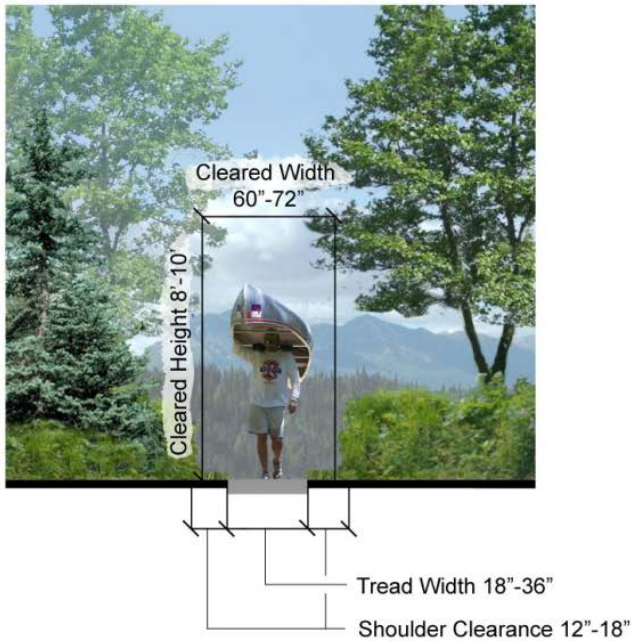
Class 1



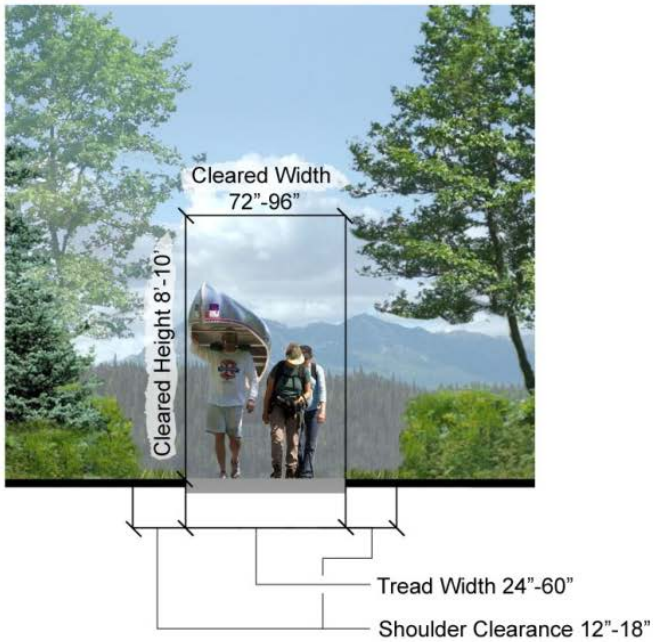
Class 2



Class 3



Class 4



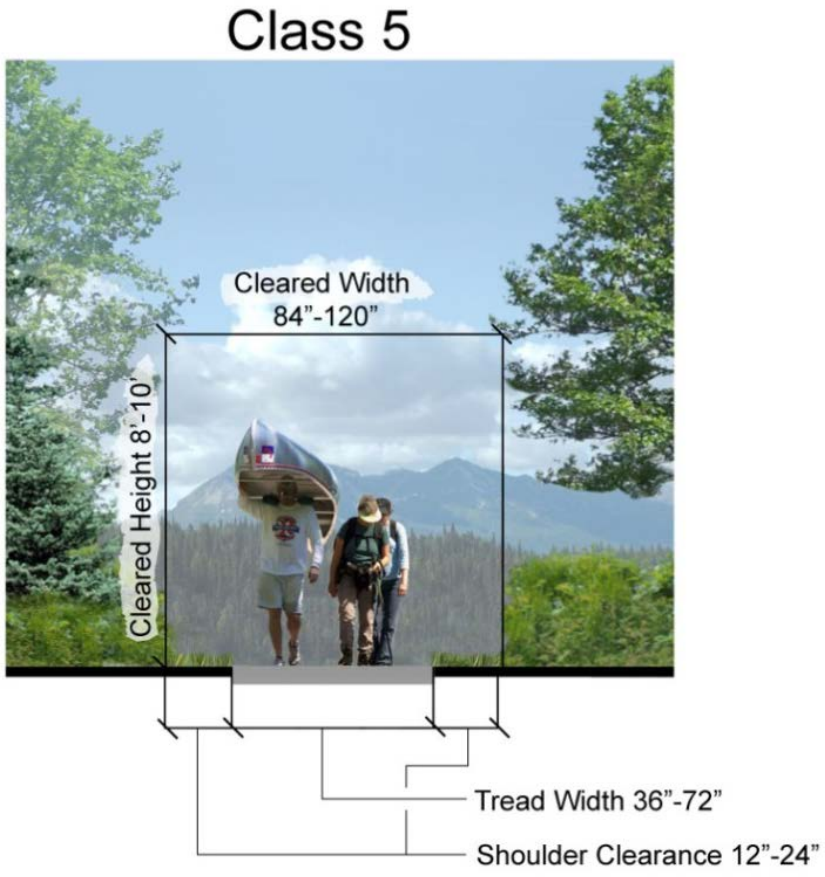


Figure 3.9.1 Canoe Portage Trail Design Parameters

Section 4: Sustainable Trail Design Framework

A "Sustainable Trail Design Framework" is necessary to create a trail system that has minimum impact on natural systems and reduced maintenance costs. A "***sustainable trail***" is defined as a trail that conforms to its terrain and environment, is capable of handling its intended use without serious resource degradation, requires minimal maintenance, and focuses on maximizing the user experience. This involves the use of integrated water control, curvilinear layout, grade control and full bench construction. While initial construction costs may be more, reduced future maintenance costs will compensate for this investment.

The guidelines on the following pages will be considered and integrated when building or improving trails within Alaska State Parks. At times, certain circumstances may make the use of some of these guidelines difficult or impossible to fully implement. In these cases reasonable measures should be taken while maintaining the spirit of the guidelines. Many segments of existing State Park trails do not yet meet sustainable standards. Where this is the case, a higher level of maintenance is required to keep the trail tread in reasonably good condition while minimizing impacts on park resources. The ultimate result of sustainable trails are park resources that provide improved transportation alternatives, recreational opportunities, environmental aesthetics, open space preservation, and increased adjacent property values.

By constructing ***rolling contour trails***, sustainability can be achieved. Rolling Contour Trails encourage water to flow off of trail tread by gently traversing a hillside and incorporating ***Grade reversals*** and ***outslope*** into their design. The list below includes the basics of *sustainable trail* characteristics. See Appendix A for diagrams of standard trail structures.

All drawings in Section 4 are original artwork by Ted Kincaid unless otherwise noted.

4.1 The Six Essential Elements of Sustainable Trails

(Adapted from Alaska Trails *Sustainable Trails 101* curriculum.)

1. **The Half Rule:** Trail grade should not exceed ½ the sideslope that the trail traverses; if so, it becomes a *fall-line* trail (***fall-line*** – the steepest route of descent down a slope. Water flowing down a hillside will travel along the *fall-line*).

2. **The 10% Average Guideline:** The average trail grade, or overall trail grade should not exceed 10% along the alignment of the trail. In most cases, keeping trail grades at or below 10% will assure long term sustainability, and this should be an objective for all trail projects, unless specifically designed at greater grades.

3. **Maximum Sustainable Grade:** This is the defined maximum tread grade that can be constructed along the trail. This is typically restricted to runs of less than 50 feet, and no more than 5% of total length of the trail. Determining the *maximum sustainable grade* for a trail involves many variables that are specific to a region or trail section. For example, soils that have a very high organic content will be less stable than those that are composed of weathered granite. Variables influencing the *maximum sustainable grade* include:

    A. Soil type
    B. Presence of surface rock or bedrock

C. Annual rainfall / intensity
D. Type and spacing of integrated water control features
E. Types of users
F. Numbers of users
G. Desired level of difficulty

4. **Grade Reversals:** These are areas at which a climbing trail levels out and then changes direction, dropping subtly a short distance (20-50 feet) before rising again. Ideally, grade reversals are incorporated into a trail's initial design as part of its *curvilinear layout* (see below). Water control features such as ***rolling grade dips*** and ***knicks*** can be integrated into an existing trail as a maintenance item. ***Waterbars*** are not recommended due to their higher maintenance requirements.

5. **Outslope:** As the trail contours across a hillside, the downhill or outer edge of the tread should tilt slightly downhill and away from the uphill trail edge. Under typical circumstances, this *outslope* should be less than 5%, although individual conditions may warrant otherwise. Anything greater will usually lead to tread creep and user discomfort. Outslope is influenced by the forces of compaction, displacement, and erosion, which collectively reduce the effectiveness of the design element. Even on trails that are constructed with proper outslope, it will often deform through time and routine maintenance is needed to restore a trail tread to its designed outslope with these forces in mind. The integration of *grade reversals* and *rolling grade dips* insure that water is managed along the trail if outslope is compromised.

6. **Durable Tread Surface:** The Tread Surface of a trail should be compacted and durable enough to support the managed use and shed water. Surfacing should take into consideration special characteristics of the soils such as the presence of permafrost, organic/muskeg soils, volcanic ash, saturated soils and other environmental conditions. Many trails in Alaska are not sustainable due to flat terrain or the soil characteristics noted above. Often, trails suitable for winter travel do not support summer use. In these cases tread surfaces require trail hardening to ensure sustainability. Trail hardening includes techniques such as gravel capping, boardwalk and planking decking, the use of geotextile surfaces, and other means to provide a sustainable tread.

4.2 Trail Layout and Design

(Adapted from International Mountain Biking Association's *Trail Solutions.*)

Control points need to be identified in the design process, because these are places that determine where the trail is constructed. A control point could be the trailhead or a public use cabin. ***Positive control points*** are interesting places that you want users to visit while on the trail. A scenic overlook (a *positive control point*) could discourage switchback cutting by making people want to stay on the established trail. Connect the trail to these *positive control points*, especially if they are near the trail, or people may end up making new ***social trails*** to get there. Make sure to route the trail far away from ***negative control points***, so visitors aren't encouraged to investigate; these places you want users to avoid can include sensitive habitats, private property, an archaeological site, etc. It is helpful to make waypoints for control points with a GPS. By plotting these points on a topographic

map, a rough sketch of the trail can be drawn using contour lines as a guide to keep the route sustainable.

4.2.1 Trail Layout Marking (Adapted from Alaska Trails *Sustainable Trails 101* curriculum.)

Once the basic route has been decided upon, a crew experienced in trail design can put in the initial flagline or staking; stakes will have distances denoted on them (0+00, 1+00, 2+00, etc.). Pin flags can then be placed between stakes that are generally 5-10 feet apart for the ***trail layout marking***. Some commonly used methods for Trail Layout Marking are described below.

Center Line Method: Pin flags are placed in the center of the trail tread. A defining line is cut through the organic layer half the tread width on the uphill side to aid in trail construction.

Uphill Edge Method: Flags mark the uphill edge of the tread. A line is cut through the organic layer on the lower boundary of the tread.

Downhill (Critical) Edge Method: The *downhill edge* is marked with pin flags. A line is cut through the organic layer on the upper boundary of the tread.

4.2.2 Trail Clearing (Adapted from Alaska Trails *Sustainable Trails 101* curriculum.)

Bright survey tape can be used to mark the boundary of the ***trail corridor*** for clearing (width and height) based on management objectives. As the corridor is cleared don't remove any more vegetation than necessary to retain the look of a trail rather than a road. (see Appendix A, Sheet 1). When pruning trees to clear the corridor, the ***"three-cuts" method*** is encouraged to keep bark from peeling off of a tree when its branch is removed. First cut from the bottom several inches from the bark collar to remove the bulk of the branch. Next, cut from the bottom just outside of the branch's bark collar. Finish cutting through the branch from the top.

When clearing trees from the tread, they must be completely removed from the tread rather than be cut at their base; as the ground is compacted the stump will protrude otherwise. By cutting to waist level initially, you can gain leverage to pull them out. If more than half of a tree or shrub needs to be pruned, it should be completely removed.

4.3 Design Concepts

(Sections 4.3- 4.3.6 adapted from International Mountain Biking Association's *Trail Solutions*.)

The goal of creating a *sustainable trail* is ultimately to define and minimize its short and long term maintenance needs. If a potential trail or system is planned and built with anticipation of impact-causing conditions (such as the *maximum sustainable grade* variables listed above), there will be less troubleshooting and reconstructing – or at least, a routine maintenance plan for the expected degradations. Planning a sustainable trail requires integration of the essential elements listed above, and also consideration of the following layout and design concepts.

4.3.1 Bench Cut Trails (See Appendix A: Figures A.2-A.4.)

Full bench construction is the preferred method when building *bench cut trails*. ***Full bench trails*** cut the tread entirely from the hillside from compacted soils, resulting in a more stable tread than the alternative, the ***partial bench trail***. In *partial bench construction*, only part of the tread is created by digging into the hillside; the rest of the tread surface is created from the excavated soil. This method is not recommended because the outer tread is not as durable as the inner tread. If it is not possible to use *full bench construction*, possibly due to an immovable obstacle, a retaining wall should be used to reinforce the tread. Five steps describe the *full bench construction* process, once the Trail Corridor is cleared.

1. **Dig the Tread.** Begin by raking the loose organics (branches, leaves, etc.) uphill for use later. Mark the upper and lower extent of the tread based on pin flag locations and prescribed trail width. Begin grubbing (using a *Pulaski*) the tread through the organic soil into mineral soil. Broadcast the debris downhill and far off the trail (using a *McLeod*).

2. **Cut the Backslope.** The *backslope* of the trail is the excavated slope above the trail *tread* and below the natural hillside. The *backslope* must be shaped to transition into the hillside to prevent erosion on to the trail. Use a *Pulaski* to sculpt the *backslope* and broadcast excess soil. Be sure to adequately pack the *backslope* with a *McLeod*.

3. **Outslope the Trail Tread.** *Outslope* is very important so water sheds across it and doesn't follow it. Use a *McLeod* to create a slope of 3-5%.
4. **Compact the Tread.** Tamp down the trail *tread* with a tamper, tamping bar, or plate compactor (dry soils can make this tricky). If not done properly trail users could pack the center of the tread leaving a concave surface for water to run down.

5. **Tread Finishing.** Remove trail markings (stakes, pin flags, survey tape). Cover the *backslope* and broadcasted soil with the loose organics that were piled up from step 1.

4.3.2 Climbing Turns (See Appendix A: Figure A.6.)

If your trail cannot climb fast enough with a sustainable grade to reach control points a ***climbing turn*** may be the solution. *Climbing turns* help a trail gain elevation without the extra work required to build a ***switchback***. Climbing turns should have a wide radius and provide a free flowing trail (as opposed to a Switchback). Climbing turns shouldn't be built on slopes steeper than a 7% grade because a short section will become fall line; to mediate this ***grade reversals*** should be constructed immediately above and below the turn.

4.3.3 Switchbacks (See Appendix A: Figure A.5.)

If the slope you are trying to climb is greater than 7% grade it may require a true ***switchback***. Switchbacks avoid the fall line by constructing a ***turning platform*** with a 2% maximum grade. This avoids having fall line sections (like the *climbing turn*), and allows climbing steeper slopes. *Retaining walls* may be needed to support the *turning platform* and trail below. The trail just above and below the *turning platform* should have a grade no greater than 5%. Above the *turning platform* the trail is *outsloped* for a short ways to drain water into an uphill drain ditch. An ideal location for a

switchback will be on the least steep terrain. A viewpoint to the outside on the *switchback* can encourage users to stay on the trail; obstacles (trees, boulders, etc.) inside the trail at switchbacks can keep people on the trail as well.

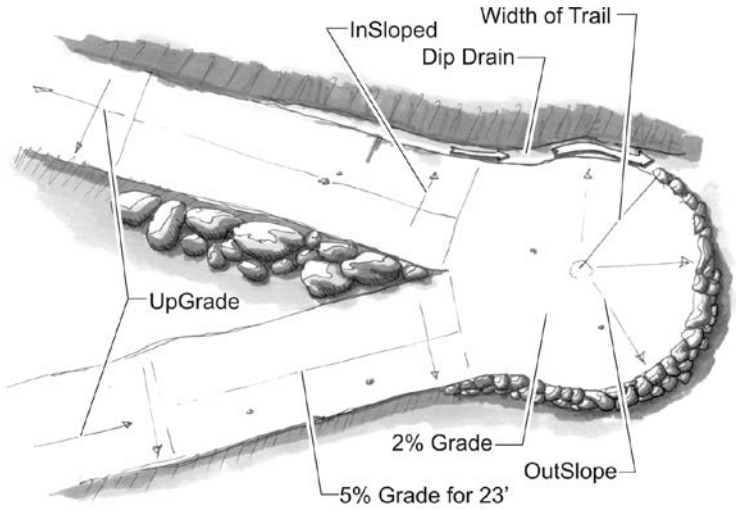


Figure 4.1 - Switchback Design

4.3.4 Retaining Walls (see Appendix A: Figure A.17.)

Retaining walls may be needed for switchbacks or partial bench construction. Rock is preferred over wood for its durability. The source rock should be heavy, blocky, and be found locally. Make the footing *insloped* when excavating the footing for the *retaining wall*. Large rocks should be embedded below the soil surface for the base. The next layer(s) of rocks should be offset so the joints don't overlap. As each rock layer is added the fill should be compacted. Walls should also be tilted inward (this is referred to as ***batter***) towards the trail and back filled with gravel and/or mineral soil. Large flat capstones should keep everything together.

Crib walls are retaining walls constructed with logs or treated timbers. The logs are stacked and notched so they are able to hold back the fill material. As with rock *retaining walls*, each log layer is added the fill should be packed. The walls should also have *batter* for stability.

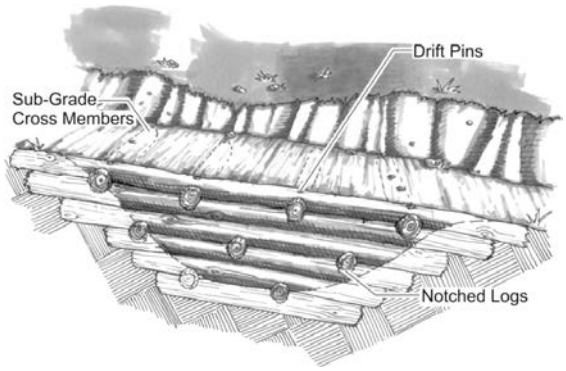


Figure 4.2 - Crib Wall Design

Trail armoring is used to make a trail more durable using rock, and may be necessary in certain situations. Heavily traveled trails, overly steep trails, or trails that traverse damp soils may need some reinforcement. Below a few common armoring techniques.

Flagstone paving is the simplest method, and involved placing large flat stones on mineral soil (organics removed from surface), or a mix of aggregate. ***Stone pitching*** is the process of skillfully placing stones on end into the ground, carefully aligning rock joints. ***Raised tread construction*** can be used to lift tread above wet ground. Large rocks are placed into mineral soil, a layer of smaller rocks is placed above, and capped with aggregate.

A few of the following tips may be useful in a trail Armoring Project.

1. Angular square-shaped rocks work far better than rounded for trail armoring.

2. Gravity makes working from the bottom to the top much easier.

3. Trail compaction is just as important with rock construction as it is with soil, so take the time.

4. It may be advantageous to add natural barriers to the edge of the trail, especially in wet areas, to keep people on the trail.

5. Be sure to fill any gaps between armoring rock.

6. ***Keystones*** that are trail width and very heavy should be placed every 4 to 6 feet to keep the armoring in place.

7. Avoid aligning joints when assembling stones, as this can weaken the structure.

8. Continue to use sustainable trail techniques; keeping water from running down the trail will help the armored trail last much longer.

9. Rolling rocks is not preferred. This can be dangerous, and the rocks probably won't stop in their desired location.

10. Have at least 3 *pry bars* on hand for moving rock.

11. *Rock hammers* with *chisels* can shape rock, while *sledgehammers* can help wedge stones or break them. *Pulaskis* are a good choice for digging and rock positioning.

12. It's easiest to use local rock, but quarry from an area out of sight from the trail, and uphill if available. Restore quarry area after work is complete.

4.3.6 Geosynthetics

Geosynthetics are man-made materials that help stabilize soils or prevent their mixing. ***Geotextiles*** (***Geotex***) keep layers from mixing, while allowing water to drain through. These are used in boggy areas to separate the wet soils from the overlying material that will be placed on top to create the tread surface. A honeycombed plastic panel called geogrid ***Geocell*** can be used to hold soils in place when the soils are wet. Use only when appropriate, because it is fairly expensive.

4.3.7 Water Crossings

(Sections 4.3.7- 4.3.8 adapted from International Mountain Biking Association's *Trail Solutions*, and USFS Wetland Trail Design and Construction)

Water crossings can be the most complex part of trail construction, and should be avoided if possible. It is important to know if your stream crossings will affect wetlands or anadromous streams for permitting reasons and habitat protection. It is best to avoid water crossings unless absolutely necessary, but it is usually impossible to route a trail without crossing one. Before deciding on a water crossing method it is best to consult historical stream flows and assess the riparian habitat. The goal is to create a sustainable corridor while minimizing impacts to the waterway.

A trail should always descend to a water crossing and climb out of it so water never has the opportunity to follow the trail downhill. *Grade reversals* should also be present near the stream so water doesn't erode the trail surface into the stream. There are three main types of water crossings: a ***stream ford***, a ***culvert***, or a ***bridge***. When constructing a *stream ford* or a *bridge* the most suitable section of a stream will be in a riffle area (not a meander); although stream channels will migrate over time, this is will be the most stable area.

A ***stream ford*** is an armored crossing that used large stones to increase the durability of a stream crossing and both entrances to it. The trail on each side of the crossing should be armored for several feet to guard against sediment or the trail washing out during high flows. This technique is only suitable for streams up to three feet deep, and beyond that a bridge may be necessary. The most durable method of stream armoring is *stone pitching*.

A ***culvert*** (see Appendix A: Figure A.12) is a conduit to deliver a small volume water beneath a trail; this can be accomplished with plastic or metal piping or rock structures. Wood is not durable and isn't recommended. It is important to get some information from locals about the maximum flows, look at evidence in the stream bed. Although *culverts* are often the cheapest solution to a water crossing, they require maintenance, and need to be installed correctly to avoid habitat disruption and drainage problems. A *culvert* should be at least as wide as the stream bed and ideally as wide as the largest flows expected. If the *culvert* isn't wide enough, it may clog quickly. *Culverts* may not be the best solution in an anadromous stream, although a better option may be to cut a *culvert* lengthwise and install it as an arch. There should be at least one foot of soil above the culvert.

Bridges are appropriate for stream large stream crossings that may otherwise be dangerous to ford, or have high peak flows. They can be a complex engineering project or as simple as a log with a hand rail. *Bridges* can be quite expensive and often require permits, so plan accordingly. Large *bridges* will likely be constructed by engineers, but below are some helpful hints on building smaller scale wooden bridges.

1. Strip bark off of local logs to postpone rot and prevent insect damage.

2. Unfinished wood harvested near the bridge site will not have the longevity of treated wood and may need to be replaced often.

3. Due to rot potential, wooden ***stringers*** (structural supports for a bridge that span the width of the stream) should not rest on the ground.

4. Screws and bolds will hold bridges together better than nails.

5. There should be a clear line of sight for people on either side of the bridge for motorized and bicycle trails.

4.3.8 Wetland Trail Structures

Trails should be routed away from wetlands whenever possible, but sometimes this is unavoidable. Keep in mind there may be extra permitting or environmental studies involved. *Trail armoring* and *geosynthetics* are possible solutions for trail construction in damp soils, and are mentioned above. ***Turnpike***, ***causeway, puncheon***, and ***bog bridge*** are other options to cross wetland soils.

Turnpikes (see Appendix A: Figure A.14) are typically an effective option for crossing wet soils. They are suitable when the water table is high, there is no more than a 20% *sideslope*, and soils are at least moderately drained. It is appropriate for consistently wet soils that don't experience flooding. *Turnpike* is built by first excavating ditches on each side of the trail location. A shallow trench can then be dug between ditches and be filled with rock/aggregate; above that should be *geotextile* fabric topped with compacted gravel. The tread surface should be crowned. Rock or log ***retainers*** should be used to hold the tread together, although rock is preferred for durability. Pins should be placed on the outside of retainers to keep them in place. To encourage drainage away from the trail, ***culverts/drains*** and ***leadoff ditches*** are periodically needed. On steeper terrain ***stepped turnpike*** (see Appendix A: Figure A.15) can be used.

A ***causeway*** is a *turnpike* without side ditches. These take less time to construct, and may be suitable for seasonally wet areas. Keep in mind there is less drainage involved in this trail structure.

Puncheon uses ***mud sills*** and ***stringers*** to elevate decking above wet soils. *Mud sills* rest in excavated soils. *Stringers* rest in notches on top of the *mud sills*; they should be connected by ***lag screws***. *Stringers* have a flat surface on top to lay decking on. The decking should be treated lumber, and securely nailed into the *stringers*. A ***kickrail*** can also be added above the decking to guide walkers' feet. This is often installed on *puncheon* that is more than a couple feet above ground; this should be nailed to the decking. Keep the decking level to prevent hikers from slipping.

A ***bog bridge*** is a simple trail structure that consists of treated timber planks resting on sleepers. The tread is usually one or two 12 inch planks from 6 to 9 feet long. Sleepers rest approximately every four feet, dependent on plank thickness, in excavated soil, and planks are nailed to notched sleepers. *Bog bridges* are commonly used in backcountry areas because they require less material than *puncheon*. For areas that gain elevation the *step and run technique* can be used; use spacers to elevate the planking on steeper terrain. Keep decking level to prevent a slipping hazard.

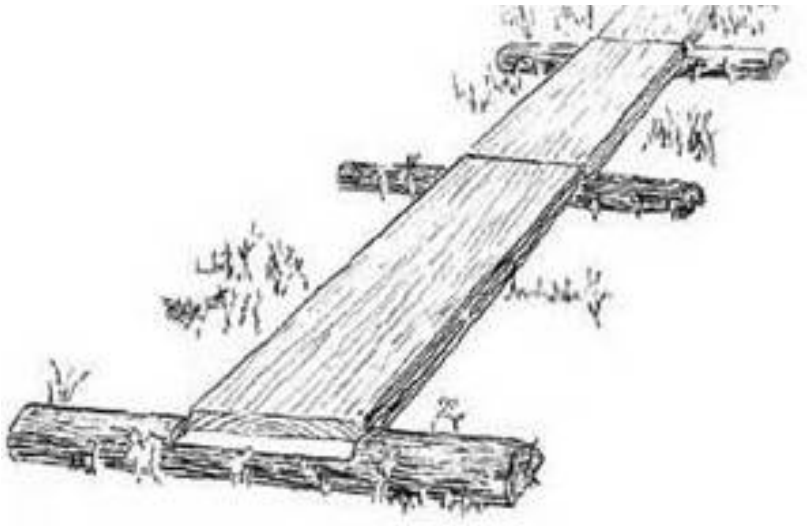


Figure 4.3 - Bog Bridge (USFS *Wetland Trail Design and Construction*)

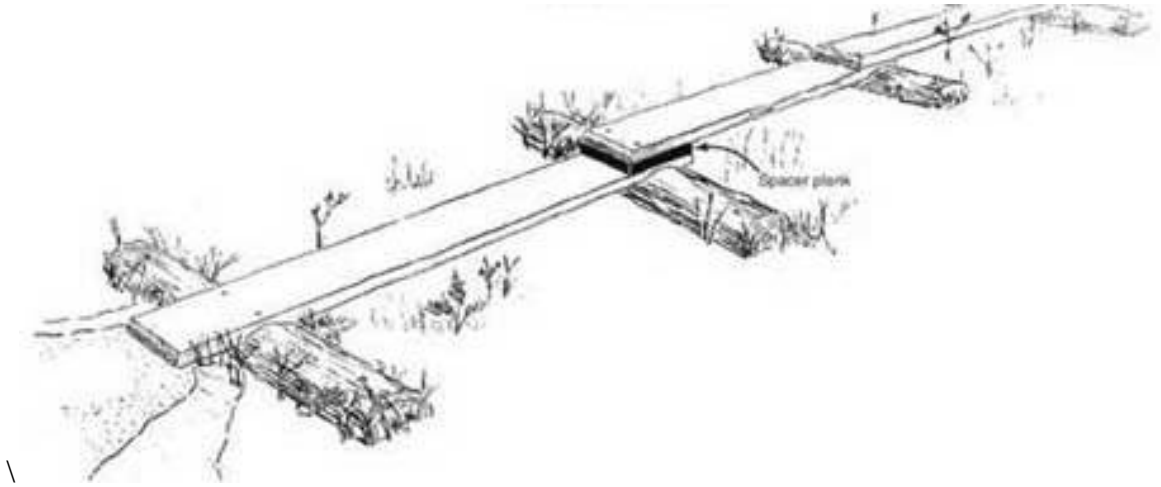


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Figure 4.4 - Bog Bridge: Step and Run Technique (USFS *Wetland Trail Design and Construction*)

4.3.9 Trail Maintenance

(Sections 4.3.9- 4.3.10 adapted from International Mountain Biking Association's *Trail Solutions*.)

Trails need to be maintained periodically to prevent resource degradation and give users a quality experience. Vegetation needs to be cleared from the trail corridor based on Trail Management Objectives. Spring is a good time to clear logs, and Fall is a good time to trim overgrown grasses.

When clearing woody brush, make sure to cut to near the bark collar or to the ground to avoid "***punji sticks***" that trail users can potentially trip or impale themselves on. When clearing, give emphasis to downed trees that users are detouring around or trapping water; both can lead to trail degradation. Roots should be removed if they present an excessive tripping hazard or run parallel with the trail. Raised roots may be evidence of an erosion problem.

Drainage specific problems may develop over time without maintenance. This may be especially true with trails that weren't designed sustainably. If water is flowing down the trail, the outslope may need to be restored or the tread may need to be ***de-bermed*** (removing the berm on the downhill side of the tread). Other options are to add trail structures such as a ***knick*** or ***rolling grade dip*** as problems arise.

Knicks are five to ten foot semi-circular sections of trail that are shaved down to a 15% outslope; they are added to divert water from a ponded area on a trail. A *rolling grade dip* uses the soil from a *knick* to build a ramp on the downhill side of the *knick*. The ramp should be at least ten feet long and gradually blend into the trail. Occasionally *knicks* and *rolling grade dips* need clearing of silt, leaves, and twigs. Avoid using ***waterbars***; they require maintenance, people often walk around them, and they easily fill with sediment. If your trail is steep, has running water down it, and a reroute isn't possible, the techniques above along with armoring may be the only solution.

It is also important to keep trail structures in working safe order, these structures will periodically need new decking and planks. A board with a nail in it can certainly be a hazard. At some point trail structures will reach the end of their useful life and will need to be completely replaced.

4.3.10 Trail Reclamation

In certain situations it may be necessary to reroute a trail or section of trail. Significant maintenance may be needed to maintain a trail designed without sustainability in mind. If a trail suffers from one or more of the following problems it may be prudent to look at possible reroutes: tread erosion, excessive grades, marshy terrain, trail-braiding (users avoiding a muddy or rutted section).

Before rerouting a trail make sure the public knows the purpose, because some people probably enjoy using the trail no matter what state it is in. Community meetings and signs may help communicate goals to be accomplished by a trail reroute.

An especially important part of creating a reroute will be to reclaim the original trail. If a degraded trail isn't reclaimed it can decrease water quality, become an eyesore, and confuse trail users. Begin by ***scarifying*** the old trail. This will prepare its surface for new vegetation to grow; use native seeds. If above tree-line or in an open meadow, you may be able to transplant the vegetation mat from the new trail to reclaim the old trail. Logs, leaves, and other organics can be spread to further disguise the area. If the erosive forces are too much, ***check dams*** may need to be installed to trap sediment on the trail. Rocks, logs, or burlaps sacks filled with soil may be used.

4.3.11 Special Implications for Alaska

Alaska has some unique challenges when it comes to trail building. In some regions, the geography and geology may make construction very difficult or expensive. Here are a few things to be aware of.

There are countless winter trails in Alaska that often follow the easiest way from A to B across snow and frozen rivers, and swamps. As ice and snow melts many of these winter trails continue to be used during the summer. As trail becomes muddy, users will hike/drive around the muddy areas. This trail can turn from multiple braids to an impassable mud bog. A wetland suitable trail structure may be advisable if there is no other option to connect trails on better soils. If most of the trail is across wetland soils a complete reroute or seasonal closure may be necessary.

Section 5: Trail Inventory and Assessment

Since 2007 the Alaska State Parks Inventory and Assessment Project has mapped and assessed conditions of most trails throughout the Alaska State Park System. Mapping-grade ***differential GPS*** (DGPS) equipment has been used to collect the geographic alignment as well as the state of the trails and their related structures. The data continues to be used for map production and trail management.

Several products result from the Inventory and Assessment Project including the Alaska State Parks Trail Browser, state park unit overview maps, trail guides, as well as management maps on an as-needed basis. As trails are constructed and rerouted, State Parks trail data and maps will need to be continually updated.

Data collection involves using the ***DGPS*** (differential global positioning system) receiver to collect trail data. For those new to the process, there are a few tasks that should be completed beforehand. It is a good idea to take a GPS to GIS course if available. The first step is to read through the ***Alaska State Parks Data Dictionary*** (ASP_2010). The Data dictionary describes all of the attributes and values that can be collected by the *DGPS*, as well as associated definitions, and trail browser codes (see appendix B). Minimum Mapping Requirements is another document to read developed by DNR DMLW that outlines basic mapping guidelines (see appendix C).

The next step is to become familiar with the *DGPS* equipment. Alaska State Parks currently uses Trimble DGPS equipment with an external real-time beacon. Newer Trimble *DGPS* products can perform the necessary mapping tasks and need not be identical to the current equipment, but an external antenna should be used at all times; this helps the *DGPS* perform in forested areas. Real-time corrections obtained from the beacon within the antenna are helpful when relocating a feature previously mapped, but is not necessary during initial mapping; post-processing can be used to achieve similar results. To keep data consistent, the Trimble GPS Pathfinder software platform should be used with the ASP_2010 data dictionary.

5.1 Trail Data Collection in the Field

The current (as of 05/15/2012) *DGPS* configuration uses an external receiver carried within a backpack, with the antenna extending from a pole mounted to the backpack, with a hand-held data collector (see picture below). Charging batteries for both the receiver and data collector are required. Before heading to the field it is recommended to check settings of the device in the setup menu of Pathfinder (see appendix D for configurations).

There are several other items that are used the mapping process to be familiar with including the ***clinometer***, compass, camera, tape measure, field book, and map. Make sure to research the area you are visiting beforehand. Other items not involved in the mapping process, but advisable to carry while mapping are a satellite phone (especially remote areas), a first aid kit, and bear spray.

The mapping process requires two people. The mapper (using the *DGPS*) is responsible for recording the trail data with the data collector. The mapping assistant determines and communicates trail grades (using the *clinometer*) and announces changing trail attributes to the mapper; other

duties include updating the field book, and taking photographs. For more information on using a clinometer see section 6.2. Notes are also taken in the field book before, during, and after mapping (see figure 5.1 below).

Figure 5.1 - Field Book Notes

The first few mapping trips should be for practice. The basic process goes as follows:

1) Begin field book template.
2) DGPS Equipment is assembled for data collection.
3) GPS Pathfinder Office is initialized.
4) Antenna height is measured and entered in data collector.
6) Begin new file.
7) Set time in camera.
8) Photograph the UTC time as the first photograph.
9) Collect point and polygon attributes near the trailhead.
10) Mapping assistant walks down trail 50 feet ahead of mapper while voicing trail attributes.
11) Continue mapping the trail; map point and polygon attributes when necessary.
12) When finished mapping, close the file and backup to flash memory.
13) Turn off GPS.
14) Carefully repack GPS equipment (either in plastic cases or within the backpack).
15) Update field book.

5.1.1 Data Collection Guidelines

1) For all point features not mentioned in the Minimum Mapping Requirements log for 10 seconds.
2) Collect data with the antenna level and close to the feature as possible.
3) As a general rule segment the trailway every 50 feet, but try to segment where the grade or conditions change.
4) Ensure the mapping assistant consistently walks about 50 feet ahead.
5) Keep GPS volume high enough to hear changes in satellites and data logging sounds.
6) Always use the external antenna.

5.1.2 Photo Points

1) GPS-Photo Link Software uses recorded time to tell photos apart. This requires the mapping team to wait at least 60 seconds between photo points.

2) The first photo of every mapping day must be of UTC time from the data collector. It is not necessary to collect a photo point with this photo, but wait at least 60 seconds after the UTC photo is taken to collect the first photo point.

3) After logging a photo point, take the photo immediately. If more than 15 seconds pass, it is best to delete the photo point, wait 60 seconds, and try again.

4) Try to take pictures with the sun at your back if possible. In low light situations hold camera with two hands and using a flash may be helpful. Some photos benefit from a sense of scale. A person or familiar object may give a photo a better perspective.

5) Refrain from taking photos that aren't photo points, because it makes geo-tagging the photos more difficult. If any photos are taken that aren't photo points record the subject matter and the time taken in the field book, to help avoid confusion.

6) It is good practice to upload photos to a computer after each field day.

.2 Trail Data Office Protocols

At the end of every field day it is advisable to upload files from the data collector to the program server using the GPS Pathfinder Office Data Transfer Utility. If out of the office, uploading data to the program laptop will suffice. If mapping in a remote location, backing data up to the data collector's flash drive may be the only option.

To keep projects organized, use a consistent folder structure and naming convention. Mapping documents (generally .mxd and .pdf files) should be given an obvious unique name and a date (remember not to add spaces). Example: "ChugachSP_Overview_01-02-12.mxd." See the folder structure used on the server in figure 5.2 below.

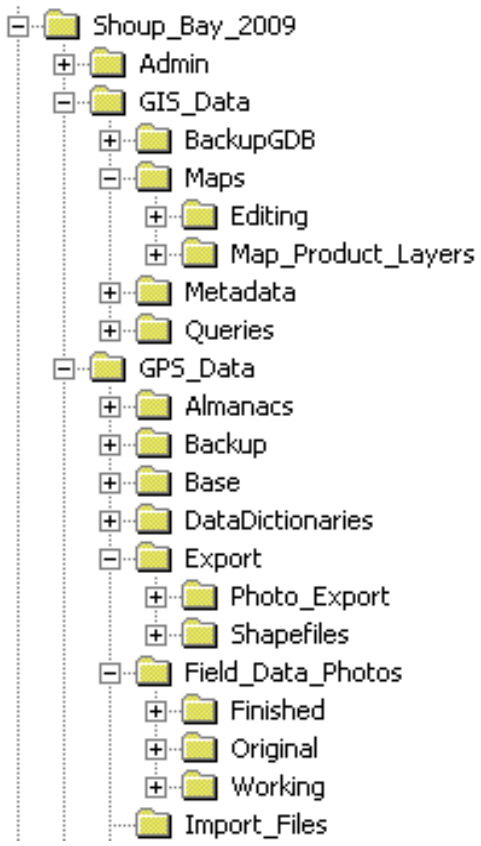


Figure 5.2 - Mapping Data Folder Structure

After uploading the data to the server it may be necessary to post-process with the Differential Correction Utility. If real-time corrections aren't received continuously through the mapping process, then post-processing should be performed.

Before using the Export Utility, look through all of the settings to make sure they match the desired export configuration. See appendix D for the proper export settings. These settings can all be saved when creating a new export configuration.

Photo points must be exported separate from the other attributes. One export should be only photo points; the other export should be the rest of the attributes.

The next step is editing the data. This involves three main tasks:

1) **Connect gaps between line segments**. Sometimes line segments are recorded by the GPS with gaps between them. In an edit session, these segments must be connected by adding a new vertex close to the gap and snap the endpoint to the next segment to close the gap in the trail. This requires zooming in closely to look for all gaps.

2) **Flip Lines**. The line segments must all be traveling the same direction to create elevation profiles for trail guides (discussed in section 5.3.3). If a trail was mapped entirely in the same direction the lines will all be aligned correctly. If one section of the trail is mapped E

to W, and another W to E (discouraged) then one section will have to be flipped (right click segment → flip lines) in an edit session.

3) **Edit attribute table errors**. There are a few common attribute table errors. If you realize you made an error in the field it is best to correct it then. If you have made an error over many segments (example: calling a trail the improper name over 50 segments) it may be easier to fix the error in an edit session. If you catch it and intend to fix it later make sure to record the date, time, and feature(s) to correct in the field book. Look carefully through the attribute tables for any obvious errors. Next, check that the trails are named correctly. An easy way to do this is to highlight an entire trail in the attribute table and look at the map (with a base map loaded for reference) to make sure the proper trail name is denoted.

Some attributes need to agree with each other. The first two are **TRL_GRADE** and **SIDE_SLOPE**. It is not possible for the **TRL_GRADE** to be steeper than the **SIDE_SLOPE**. **DRAINAGE** also needs to agree with **DEGRADE**. For example **WELL DRAINED** does not agree with **MUDDY**.

Each attribute needs to have metadata that uses the Federal Geographic Data Committee (FDGC) standard FGDC-STD-001-1998. This is especially important when sharing trail data with other agencies. More information can be found here: http://www.fgdc.gov/metadata/csdgm/

5.2.1 GPS Photo Linking

(Screen shots from GeoSpatial Experts GPS-Photo Link software version 4.2.60)

GeoSpatial Experts GPS-Photo Link software is used to link attribute data to digital photos for the Alaska State Parks Trail Browser. These following steps make the GPS Photo Link process much easier. The photos are originally uploaded into the *Field_Data_Photos→Original* Folder. Next copy them into the *Field_Data_Photos→Working* Folder. Create folders within the *Working* folder based on the date and trail names in the following format: **2009-08-12_AprilBowl_GoldCordLake**. Within the *Working* folder create folders based on trail names to place the photos in.

The following steps will give you GPS linked photos with a consistent time stamp as show below. After opening GPS-Photo Link select *Camera Folder* as *Folder Source*. The *Camera Folder* will be the folder for one set of trail photos from one day. The root folder will be the *Map_Product Layers→Finished* folder; the output folder will be the identical folder structure within the finished folder. Select *No Action* for *Original Photo Action*. Use the exported **PhotoPt.shp** for each set of photo points, and set the Alaska time zone; use Lat/Lon and NAD 83. Use photo of GPS receiver for method of time synchronization. Use the following settings for time matching:

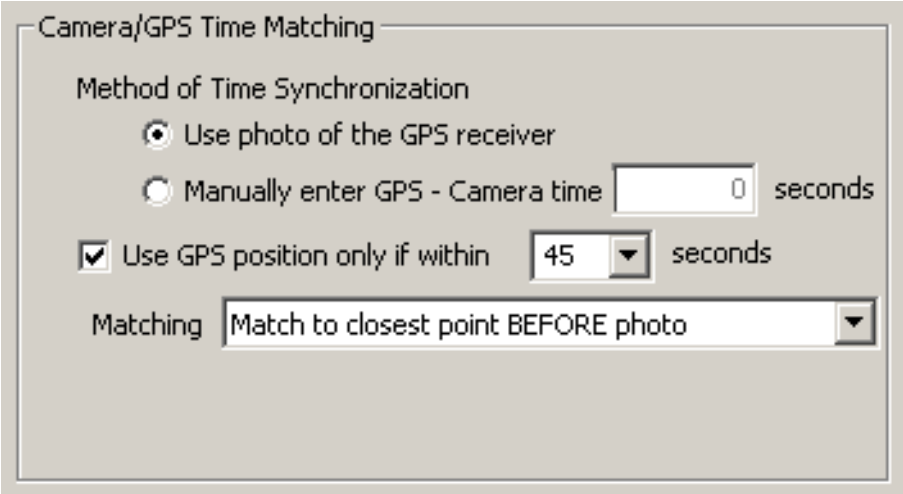


Figure 5.3 - Camera/GPS Time Matching

Wait at least 60 seconds between taking photos. The 45 second setting above will give a 15 second buffer if another photo point is accidentally recorded a few seconds early.

When you get to the *Time Offset Entry* window the *GPS time* will likely be different than the UTC time from the GPS data collector. The hour should be correct, but the minutes and/or seconds may not be. Change the *GPS time* to reflect the time on the data collector, and check the box to *Use this photo for time entry*. Keep in mind that you should match up the GPS and camera's clock before the *time entry photo* is taken.

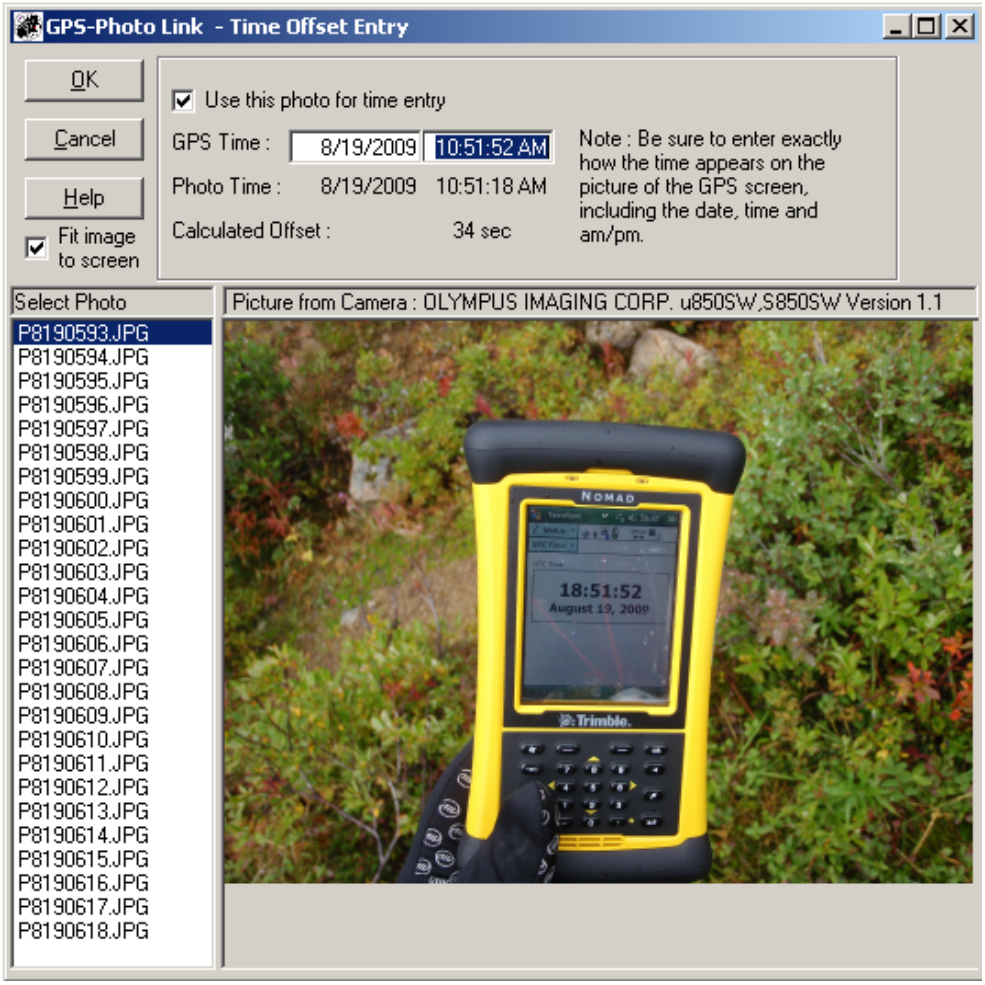


Figure 5.4 - Time Offset Entry

If the time isn't adjusted the photos may not be GPS linked; if so the *Lat* and *Lon* fields will not be filled in on the successive window. If those fields do show up, then you can fill in the *Title for All Photos* as park name, and *Sub-Title for All Photos* as trail name. As part of the file renaming process, enter the park's initials and trail name into *Photo Comment* in the following format: **HPMA_LaneBasin_** ; the *Photo Comment* must be copied and pasted for each photo. If latitude and longitude fields don't show up for some photos, try shortening *Camera/GPS Time Matching* settings.

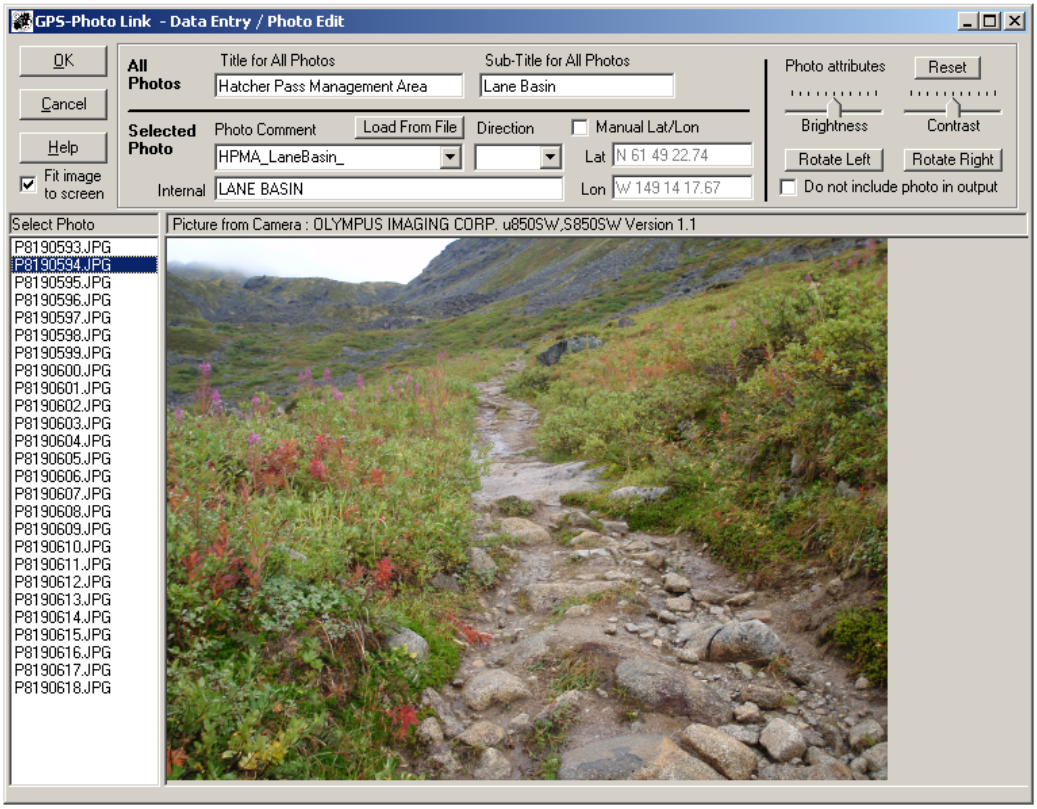


Figure 5.5 - Data Entry/Photo Editing

In the next window select *Watermarked Photo* and *ESRI Shape File* as *output formats*. Match the rest of the settings shown below.

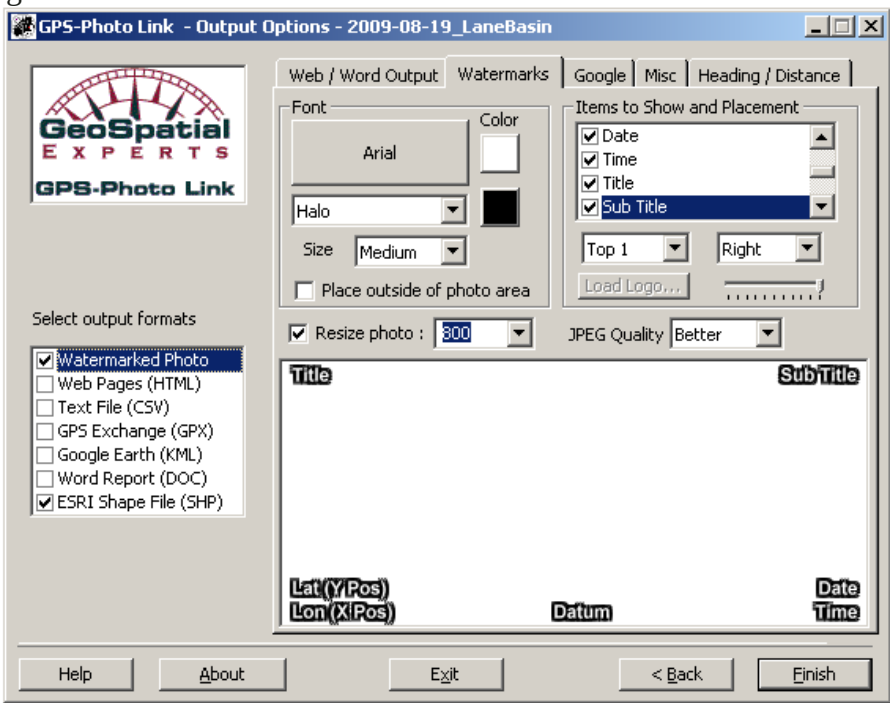


Figure 5.6 - Output Options

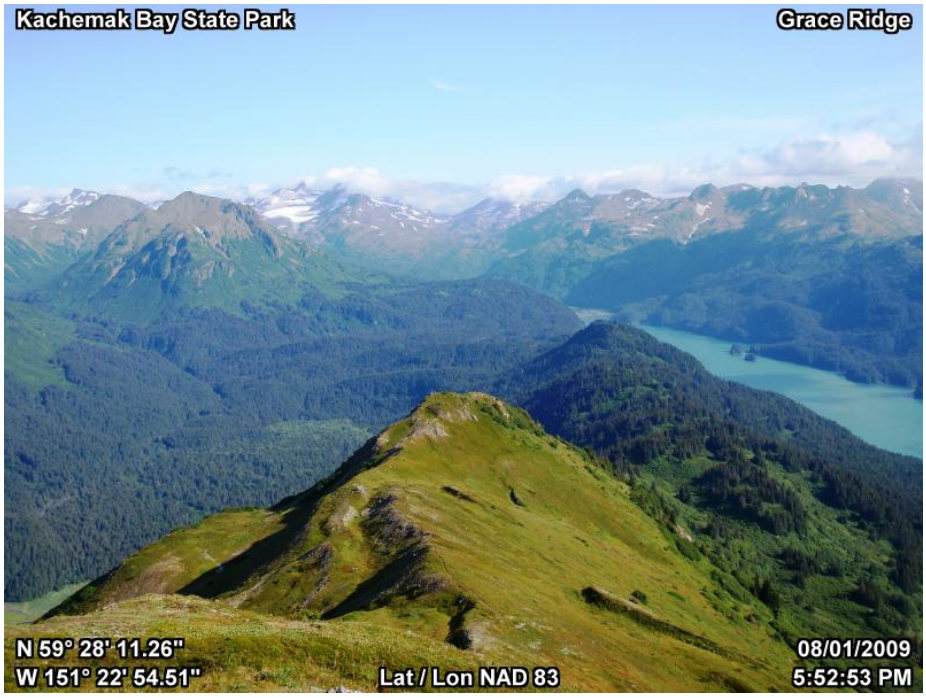


Figure 5.7 - Watermarked Photo

After processing all but one photo (the time entry photo) should have been photo linked. Within the newly created folder should be a thumbnail (**…small.jpg**) and a watermarked photo (**…tag.jpg**) for each picture, a track shapefile (**track.shp**), a picture shapefile (**picture.shp**), and **GPS-Photo Link.ini**. There is further processing before transfer to the Alaska State Trails Browser that is beyond the scope of this handbook. Further steps need to be discussed with the web developers.

5.2.2 Park Maps

Figure 5.8 - Denali State Park Overview Map (created with ESRI ArcMap 9.3.1)

Overview maps are made to depict trails and facilities in state park units and state park managed areas. These areas are where the trail systems have been mapped and assessed. These maps should be consistent with other park maps and conform to DNR DMLW's Minimum Mapping Requirements (see appendix C). The following settings and guidelines should be followed when creating or updating maps with ESRI ArcGIS software.

With all maps it is generally easiest to start with a completed map, save it as a new name, and alter it from there. Often maps share many elements so this can streamline the process. The .mxd files should be saved within the maps folder (ParkName_20XX→GIS_Data→Maps). When map layers are identified they must all be copied into the *map_product_layers* folder; linking to layers on the State of Alaska server can lead to dead links when files are inevitably moved.

It can be helpful to rename layers (before they are added to the map) to reflect clearly what they are. A map name, layer description, and date can be expressed for Lakes in the Nancy Lake Recreation Area as follows: **NLSRA_Lakes_01-01-12.shp**. The following layers are used in park maps, although others may be needed as well.

The larger park maps measure 36 by 48 inches in either portrait or landscape, the smaller park maps measure 18 by 24, and the trail guide maps (mentioned in following section) measure 8.5 by 11. Maps

should use North American Datum of 1983 (NAD83), the State Plane Coordinate System, and a Transverse Mercator Projection.

Maps should contain a key that identifies every symbol and geographic feature. There should also be contact information and a disclaimer explaining the map's purpose. Alaska State Parks and Department of Natural Resources logos should also be present. A scale bar, scale text, projection, coordinate system, datum, and a locator map or maps should also be on the map.

5.2.3 Map Layers and Symbology

Layers from Data Collection

These layers are features that come from DGPS data collection. All of these layers are used during editing; only some are needed for overview maps and trail guides; management maps may include any number of these features.

> AquaProb, Anchor_P, Building_Ed, Building, Drainage_St, Hazard, Parking, Refer_Po, Restrict, Roads, Signs, Structur, Switchba, Trailway, Trl_Stru, and Water _Xi.

Contour Related Layers

These layers are discussed further below:

> Contours, Contour Annotation, and Feature Outline Masks

Layers from Other Sources

These layers can come from a variety of sources. Check with the DNR DMLW GIS Coordinator to see which are available through the DNR GIS server.

> Hillshade, Digital Elevation Model (DEM), Digital Raster Graphics (DRGs, scanned USGS quads), GIS Servers, Trails (ORV, snowmobile, non-motorized, water, routes), Roads, Park/Land Management Boundaries, Land Status, Private Property, Lakes, Rivers, Streams, Glaciers, Parking, Buildings, Restriction, Park Boundaries, Section Lines

There are several processing procedures used to make maps. They include digitizing, creating contours, and buffering park boundaries. Before starting any of the above procedures, the map's .mxd document should have at minimum the following layers: DEM, Hillshade, DRGs (for reference), glaciers (if applicable), and layers to digitize from (aerial/satellite imagery, GIS server, or DRGs).

Digitizing

Digitizing may be necessary if layers lack enough detail for the map's scale, or do not exist. Imagery, GIS servers, or DRGs can be used, but layers using imagery are generally the most accurate and current. The process is very straight forward. A new feature class (or shapefile) is created as either a point, polyline, or polygon in the *map_product_layers* folder. It is best to digitize in the data layout, but you can edit in the map layout also. Points can be used for towns and polylines can be used for streams. Polygons can be used for glaciers, lakes, rivers, wetlands,

buildings, etc. Zoom into the feature you want to digitize. Using the editing toolbar simply trace the feature. For larger polygons you may have to merge together many smaller polygons. Save often.

Buffering Park Boundaries

Create an extent polygon feature class (or shapefile) that encompasses the entire park boundary area. Use the erase tool to erase the park boundary polygon from the extent polygon. Now buffer the new polygon created with erase. A buffer of 1300 feet and 650 feet are needed. Both buffers should be "*outside only*." The 1300 foot buffer (bottom) uses the color "Blue-Grey Dust," and the 600 foot buffer (top) uses the color "Larkspur Blue." Map settings are further discussed below.

Creating Contours

Clip the DEM so it is a little larger than the map size. Using the *Contour* tool, create 200 foot contours. Next use the *Smooth Line* tool to smooth out the contours. Then export the smoothed contours into a contours geodatabase. Next label the contours using the properties toolbar and "*convert labels to annotation*," and add the expression below for labeling contours in thousand foot intervals using the *expression* box.

Function FindLabel ([CONTOUR]) if (([CONTOUR] = 1000) or ([CONTOUR] = 2000) or ([CONTOUR] =3000) or ([CONTOUR] = 4000) or ([CONTOUR] = 5000) or ([CONTOUR] = 6000) or ([CONTOUR] = 7000)) then FindLabel = [CONTOUR]
end if End Function

Next use the *Feature Outline Masks* tool to create a masking layer for the contour annotations. In *Advanced Drawing Options* mask the contour with the feature outline masks layer. Make the mask completely transparent. Both the annotation and feature outline masks layers are selectable and movable.

Features Properties, Labels, and Map Symbols

Map symbols and labels are usually added as the last step of map production. The contour labels can be adjusted during or after this process. The geographic features' symbologies (color scheme) can be changed at any time.

Map symbols should be consistent with the rest of Alaska State Parks. They can be obtained from other maps or with the *Character Marker Bank* within the *Symbol Property Editor*. If importing symbols into ArcMap, Windows Metafiles (.emf) are most compatible. Every symbol on the map should be referenced in the map key.

Map features and labels are labeled with consistent fonts and colors, although font size varies with map scale and geographic significance. Here are some guidelines for text and labels.

Text

Map Title/Park Label: "Copperplate Gothic Bold" Bold Black 60/18
Map Key Labels: "Arial" 14 Bold Black
Disclaimer Text: "Times New Roman" Black 9

Labels

Trail Name: Calibri - Bold - Cherrywood Brown - 12
Park Facility Name: Arial - Bold - Black - 16
Street Name: Times New Roman - Bold - 14
Rivers/Streams/Lakes: Times New Roman - Bold - Italic - Lapis Lazuli - 16/12
Glacier Name: Times New Roman - Italic - Lapis Lazuli - 10
Mountain Summit Name: Bookman Old Style - Bold - Italic - Black - 10
Land Contour Labels: Times New Roman - Italic - Black - 9
Glacier Contour Labels: Times New Roman - Italic - Cretean Blue - 9

Geographic Features

Trail: Cherrywood Brown - 2
Railroad: Black - 2
Roads – Black 1/2
Lakes/Rivers: Yogo Blue (outline) - 0.4; Water Areas (fill)
Streams: Yogo Blue - 0.75
Wetlands: 420 Marsh - Leaf Green (fill) – no outline
Glaciers: Cropland - Moorea Blue (fill) – Transparency 60%
Glacier Outline: Moorea Blue - 1
Gravel Bars: Cropland – Gray 40% (foreground) – Gray 30% (background) – no outline
Moraines: Cropland – Burnt Umber (foreground) – 224, 214, 181 (background)

5.2.4 Trail Guides

Trail guides are created for frequently visited trails within Alaska State Parks. They provide park visitors with helpful information about the trail they are visiting. Trail guides are available to download and print from the Alaska State parks website. They have trail information on the first page and a map on the next.

The trail information page includes a trail description, allowable uses, distances, elevation gain, difficulty, safety precautions, park rules web link, elevation profile, trailhead access, and park contact information. Other information might also be useful such as water sources, campsites, and fishing opportunities.

The trail guides are created in Microsoft Publisher from either a horizontal or vertical template. The software has a straight forward graphic interface. Trail profile creation is discussed in the following section (Trail Profile Creation). Maps for the guides are created in the same way as the park overview maps except all maps measure 8.5 by 11 inches. Once the maps are completed in ArcMap, they should be exported to a high quality jpeg. The map should then be imported into Microsoft Publisher. Once all of the elements of the trail guide are added, it can be exported to a PDF. Before the trail guides are posted to the Alaska State Parks website, they should be reviewed interdepartmentally, and by park employees that manage the trails.

The fonts used for the trail guides are as follows:
Titles: Tempus Sans ITC - Bold - 114, 136, 66; 133, 33, 15 - 14/32
Narration: Segoe UI - Black - 8-10

Trail Profile Creation

In ArcMap/Catalog make a copy of the Trailway layer. In editing, merge all of the segments of the desired trail. Select the trail and click “create profile graph.” Right click the graph and select export as data in an excel format. Open the Microsoft Excel document. Paste the formulas “=CONVERT(A1,"m","mi")” in cell C1 and “=CONVERT(B1,"m","ft")” in cell D1. Drag both cells down to the bottom of the data. Select the two new columns. Insert a scatter plot and create an elevation graph with distance (miles) on the x-axis and elevation (feet) on the y-axis. Fonts and colors should match the trail guide (see example below). Copy and paste the elevation profile into the Trail Guide. If there are formatting issues, copy the profile to Microsoft Word first then into the Trail Guide.

Guide to

China Poot Lake Trail

in Kachemak Bay State Park

Trail Access: Halibut Cove Lagoon Trailhead; protected anchorage with mooring buoys and public dock
Allowable Uses: Hiking
Distance: 2.8 miles one way
Elevation Gain: 500 feet
Difficulty: Moderate; short, steep climbs
Hiking Time: 1.5 hours

Trail Description:

This popular trail climbs through the forest and over a low ridge, passing two small lakes where loons are common and blueberries are plentiful (August). The trail offers good views of Poot Peak and meanders through a cottonwood grove before arriving at China Poot Lake.

Park Access:

Kachemak Bay State Park is accessed via boat from the Homer Harbor. Local water taxis can provide transportation to most park trailheads.

Park Rules:

For a complete set of park rules visit:
http://dnr.alaska.gov/parks/units/kbay/kbay.htm

Camping:

Developed campsites at Halibut Cove Lagoon Trailhead, and at China Poot Lake Campsite. Public Use Cabin on China Poot Lake (reservations required (907) 269-8400).

Water Availability:

At trailhead; several small streams along trail; China Poot Lake; Moose Valley Creek.

Special Features:

China Poot Lake offers good fishing. Pleasant day hike form Halibut Cove Lagoon. Connects with many other trails in the area including Wosnesenski River, Coalition Loop, Moose Valley, and Poot Peak.

Alaska State Parks, Kenai Area Office
PO Box 1247
Soldotna, AK
(907) 262 - 5581

Figure 5.9 - Trail Guide - Trail Information Page (created with Microsoft Publisher 2007)

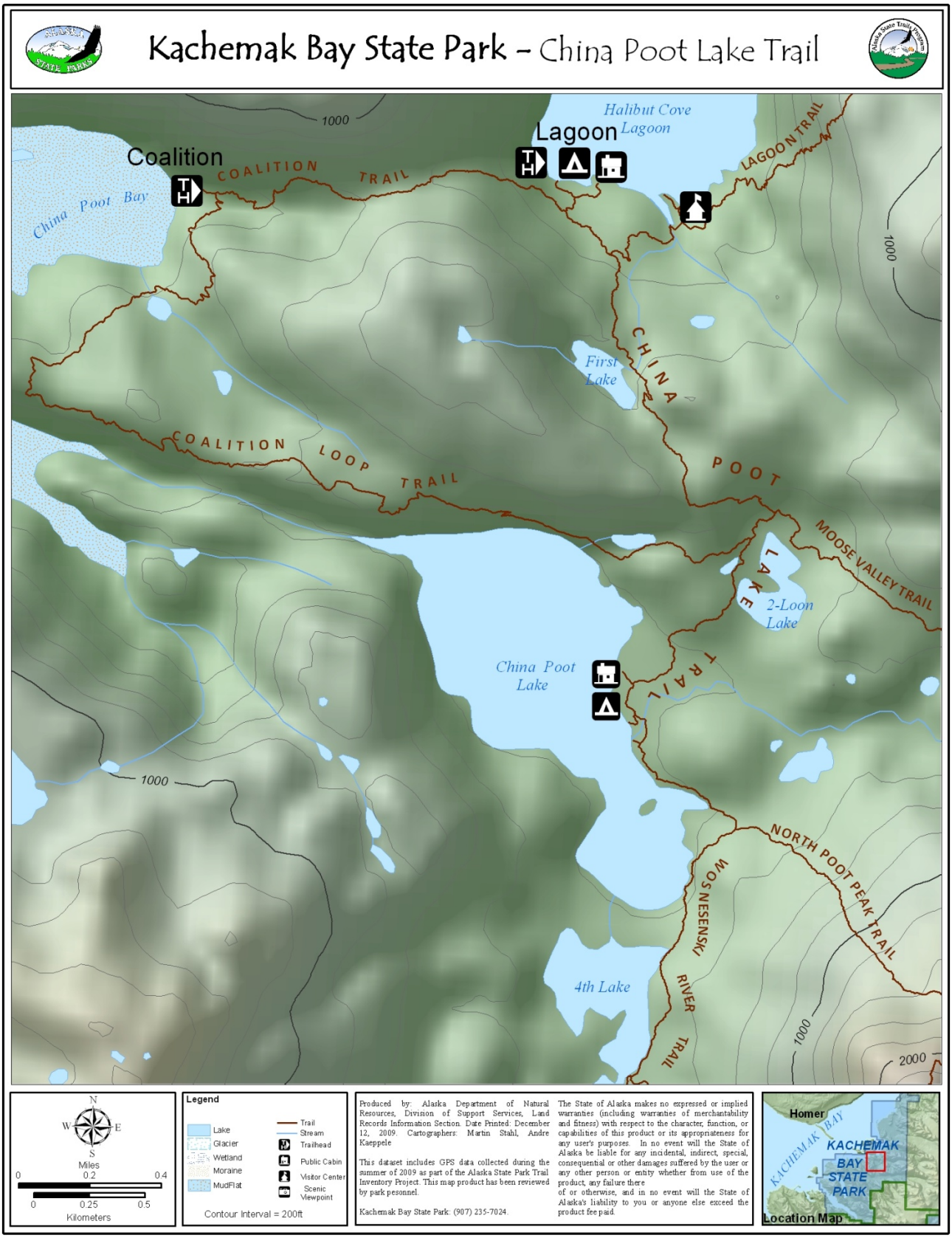


Figure 5.10 - Trail Guide - Map Page (created with Microsoft Publisher 2007)

Section 6: Trail Tools and Safety Equipment

This section contains tools and safety equipment that trail crews commonly work with. Safety guidelines are presented, followed by a list and a brief description of each tool. An overview of several tools and trail work systems are also given. All drawings in Section 6 are original artwork by Ted Kincaid.

6.1 Safety Equipment and Practices

(Adapted from the Appalachian Mountain Club's The Complete Guide to Trail Building and Maintenance.)

Although not comprehensive, the following paragraphs cover the basics when performing trail work. Specific certifications will also be necessary for performing some tasks and using particular tools.

A sturdy pair of leather steel-toed boots generally offers the best protection for your feet when performing trail work. Steel toed boots may not be the right choice for covering many miles in a day. At the very least, a well broken in pair of hiking boots is advisable. Your crew leader may require a particular type of footwear for trail work. Leather gloves will help guard hands from cuts splinters and sharp rocks, etc.

Eye protection is necessary during all trail work, and should be worn when using a chainsaw, axe, hammer, drill, or during rock splitting; other uses may also be prudent. The safety glasses should be ANSI/ISEA Z87.1-2010 compliant.

Before using a chainsaw for trail work, U.S. Forest Service Chainsaw Training, or equivalent, is required. Key points for chainsaw safety are hard hats, eye protection (in addition to a visor on a hard hat), ear protection, steel toed boots, chainsaw-specific ***chaps***, and leather or Kevlar gloves are all required for chainsaw work. Using a chainsaw is potentially the most dangerous part of trail building and maintenance, so safety protocols need to be strictly adhered to. In addition to the risk of cutting yourself, falling timber and limbs crashing down are also a concern.

Long pants and long-sleeved shirts protect arms and legs from brush and insects. Thick tightly woven cotton offers the best protection, although this isn't the best choice for long multi-day trips, as cotton takes a long time to dry compared to synthetic materials.

Every group that is working together on trails should have at least one first aid kit. It should periodically be inspected to replace items that have been used or have expired. Preferably, all trail crew should be trained in basic first aid or wilderness first aid.

It is important to always carry tools with sheaths; if the tool doesn't have one, one can be made from used fire hose. All tools should be carried with the sharp end or blade away from your body. When using trail tools, such as a *Pulaski,* be aware of the "***Circle of Danger***." This is the perimeter around a person that a tool can reach during normal use, or if the person loses control of the tool. Always be outside of this area when you are near people working with tools. It is best to have people be at least 10 feet away from you in all directions when working with tools. Lifting heavy objects is a big part of trail work. Always lift with your knees rather than your back. It may be appropriate to ask others for assistance with very heavy items. Mechanical assistance may be required as well.

6.2 Common Trail Tools

Alaskan Saw Mill - the "Alaska Saw Mill" is an attachment that is fixed to the bar of a chainsaw and is commonly used for milling decking material in for boardwalk in remote locations. When properly assembled, a mill is guided along rails that are fixed to a downed, level log. The distance between the horizontal rails and the bar determine the thickness of the boards to be cut. The horizontal rails are adjusted vertically along posts at each end of the guide and are set into place using locking screws that clamp onto the bar of the chainsaw. This attachment creates evenly planed planks that can be cut into consistent dimensions. For additional information on milling, see the Section 6.5.

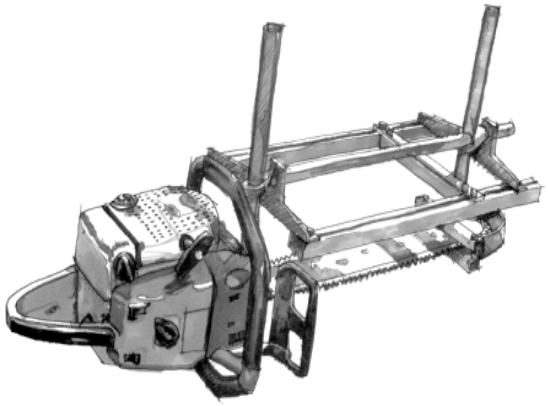


Figure 6.1 – Alaskan Saw Mill

Bark Spud or **Peeling Bar** - is a tool used to remove bark from felled timber. Most bark spuds are steel rods approximately 1.25" in diameter, 6' long, and flattened laterally at the end. At the opposite end of some bark spuds, the tops will be flattened into a 3-4" perpendicular disc. When this is done, the tool can also be used as a tamping bar to crush and compact stone around fence posts.

Bow Saw - good for cutting low branches or brush. Larger saws (over three feet long) are best for cutting logs. Make sure to cover the blade with a sheath for transport. The blades are thin so them must be replaced rather than sharpened.

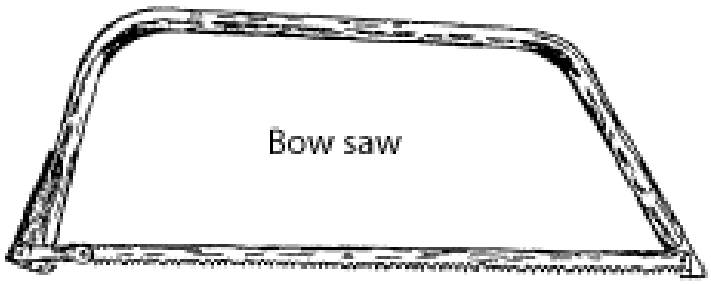


Figure 6.2 – Bow Saw

Clinometer - a handheld survey tool used in trail layout and design to measure grades of slopes and trails. For additional information on clinometers, see Section 6.3.

Drawknife - is a traditional woodworking hand tool used to shape wood by removing shavings. It is commonly used in trail construction to remove bark from logs. A drawknife consists of a blade with a handle at each end. It is pulled or "drawn" toward the user, hence the name.

Figure 6.3 – Drawknife

Felling Wedges – are wedge shaped pieces of hardened plastic used in the *kerf* of a chainsaw cut as levers to prevent the sides of a cut from pinching a saw blade before the cut is finished. Felling wedges are also used to persuade a tree fall a tree in a safe, intended direction.

Gas Powered Rock Drill - an ideal tool for drilling and chiseling rock and concrete when working on remote job sites. Rock drills are frequently used in trail construction to bore drill patterns for blasts, chiseling trail benches, and quarrying stones for masonry work. For additional information on quarrying, see Section 6.6.

Figure 6.4 – Gas Powered Rock Drill

Figure 6.5 – Gas Powered Wood Drill

Gas Powered Wood Drill – is a tool commonly used in trail construction for boring holes into logs or dimensional lumber for bridges and wooden retaining walls. Often times, stronger gas powered wood drills are needed to bore through large diameter logs or through multiple tiers of lumber to set all-thread, rebar, or wire cable. Gas powered tools such as the rock and wood drills are extremely valuable to perform trail work since in many remote settings electricity and the use of generators is not an option.

Cable Winch - are large-scale winches that instead of using spools to move rope or wire through the winch use self-gripping jaws. Powered manually by moving a handle back and forth they allow one person to move objects several tons in weight. In trail construction these are commonly used to move large logs, bridge stringers, stone, and building materials. The most commonly used is the *Griphoist* brand. For additional information on rigging and *cable winch* accessories, see Section 6.4.

Figure 6.6 – Cable Winch

Grubbing Hoe - are made for excavating trail in fine to medium-rocky soil. They are also used for removing sod and muskeg by scoring the turf and peeling up squares of organic matter. Also known as a "Hazel Hoe" or an "Adze Hoe," they are fitted with curved square handles which are distinguishably different from a pick or pick mattock handle. The handles of all three can be removed to facilitate packing and replacement.

Figure 6.7 – Grubbing Hoe

Figure 6.8 – Log Wizard

Log Wizard - is a chainsaw attachment that is used for debarking, planing, jointing, and notching logs. The attachment is fitted with two 3 1/4" planer blades to give a wide cutting surface on logs. The blades are made to be re-sharpened several times in a lifetime (by the manufacturer) or replaced with replacement blades when necessary.

Loppers - are used for pruning brush and small branches. Some have telescopic handles which can be extended in order to increase leverage and to reach high branches on a tree. Figure 6.9 – Loppers

Figure 6.9 - Loppers

Machete- is often used in Alaska by trail surveyors and hand crews when brushing out new routes/trail corridors. The machete is best used in a vertical stroke rather than the low, horizontal swing required to cut vegetation at ground level.

Figure 6.10 – Machete

Figure 6.11 - McLeod

McLeod - is typically a wildland firefighting tool with a large hoe-like blade on one side and tined blade on the other. It is commonly used in trail construction and maintenance for removing slough and berms from a trail and tamping or compacting tread. It can also be used to shape a trail's backslope.

Peavey - is a tool that provides leverage for maneuvering logs. The spike at the end of the tool creates added length and leverage, and can be used to pry logs apart. A peavey works by sliding the hook across a log until it catches in the wood. Once the hook has cinched into the wood, the handle can then be lifted to hold or turn the timber.

Figure 6.12 – Peavey

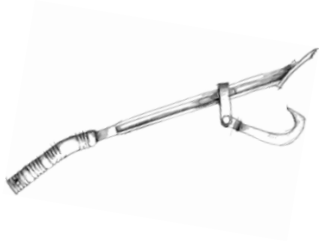


Figure 6.13 – Pickaxe

Pickaxe - is a hand tool with a hardened steel head attached perpendicular to its handle. Some make the distinction that a pickaxe has a head with a pointed end and a flat end, and a pick has both ends pointed, but most use the words to mean the same thing. The "head" is often a spike ending in a sharp point - it may curve slightly, and has a counter-weight to improve ease of use. The counterweight (as shown here) is composed of a flattened perpendicular chisel for prying.

(Pick) Mattock - is a hand tool similar to a pickaxe. It is distinguished by the head, which makes it particularly suitable for digging or breaking up moderately hard ground. A mattock has a broad chisel-like blade perpendicular to the handle. The reverse may have a pointed end, in which case the tool is called a pick mattock.

Figure 6.14 – (Pick) Mattock

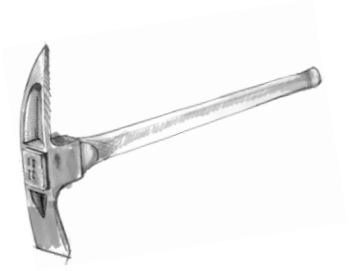


Figure 6.15 – Pole Saw

Pole Saw - a tool that enables crews to prune branches high above ground that would otherwise be out of reach. The simplest of these tools consists of a cutting blade bolted onto a long pole. Some models also have a built-in lopper that can be operated from the ground with a rope. Another useful feature is a pole that will disassemble into several pieces for carrying.

Pulaski – combines the axe and a mattock into one tool. The Pulaski is considered one of the most versatile tools for constructing trail tread, as it can be used to dig soil and chop roots

Figure 6.16 – Pulaski

Figure 6.17 – Rock Bar

Rock Bar - a 5’ long tempered steel bar with a beveled end weighing from 16-18 pounds. The length helps gain leverage when moving rocks while still maintaining its rigid shape. The bar is also ideal for breaking up rocky ground when digging holes that are problematic. Larger rock bars, such as the Peeler Bar run about 6 feet in length and often have a round disk on the end for tamping post holes. The longer bars are not designed for mechanical leverage as they are too pliable to move rock and still maintain its ridged shape.

Sandvik - is a brand name for a machete-like tool with a short replaceable blade. Because it has a smaller blade, the tool may be safer than a machete. Like the machete, the Sandvik is primarily used for removing brush and branches from trees when surveying or laying out trails.

Figure 6.18 - Shovels

Figure 6.19 - Sandvik

Shovel - a common tool for excavating organic material during the construction of trails. Shovels are often used for maintenance of drainages such as waterbars, swales, and slot-trench drains. Typically, wooden handled shovels are preferred by trail crew managers over fiberglass due to the ability for wood to better absorb shock and reduce the potential for carpal tunnel. The “R-5”, also known as a spade shovel is a more superior tool for digging than the flathead shovel, since it can be sharpened, dig with greater ease, and cut roots.

Figure 6.20 - Sledgehammer

Sledgehammer - For trail construction, sledgehammers, single and double-jacks, “chinkers”, straight-peen and cross-peen hammers are primarily used for breaking and shaping stone and driving rebar and spikes. As with shovels, it has been adopted and suggested by many other agencies to utilize wooden handles in order to reduce the potential for carpal tunnel. Wooden handles may require more frequent replacement, but will save time and money in the end with the prevention of long-lasting injuries.

6.3 Using a Clinometer

Figure 6.21 – Holding a Clinometer

Clinometers can measure grades of existing trails as well as shoot grades for new trail construction. Prior to conducting a trail survey the layout team must "level-up" with one another to properly read grades with the clinometers. Grades can be read in percent or degrees of slope angle; for trails you will use percent.

To level up, first find level ground. Many surfaces outside that look level are not, so it is best to do this in a building. Stand 10-15 feet away from your partner. Look through the ***clinometer*** with your dominant eye and line up the zero with the horizontal line. Then open your other eye and notice which part of their head the horizontal line lines up with (nose, eyes, forehead, etc.); this is the "sight to equal height." From now on when you shoot a grade with this person you will line up the horizontal line in the same place.

Some tips on using clinometers:

1. It is easiest to shoot grades with someone the same height. If you shoot grades with someone that is considerably shorter, you may have to shoot above them. To facilitate this you can either have them wear a pole, or decide that they can shoot the grades instead.
2. To find your dominant eye, line up your thumb at arm's length with an object (tree, door knob, etc.); focus on that object in the background. Close each eye; the open eye that doesn't appear to move your thumb is the dominant eye.
3. Never guess grades. Use your *clinometer*.
4. Don't rush when shooting a grade. It may take a few seconds for the *clinometer* to settle. Wait that few seconds so your measurement will be accurate.

6.4 Cable Winch and Rigging Systems

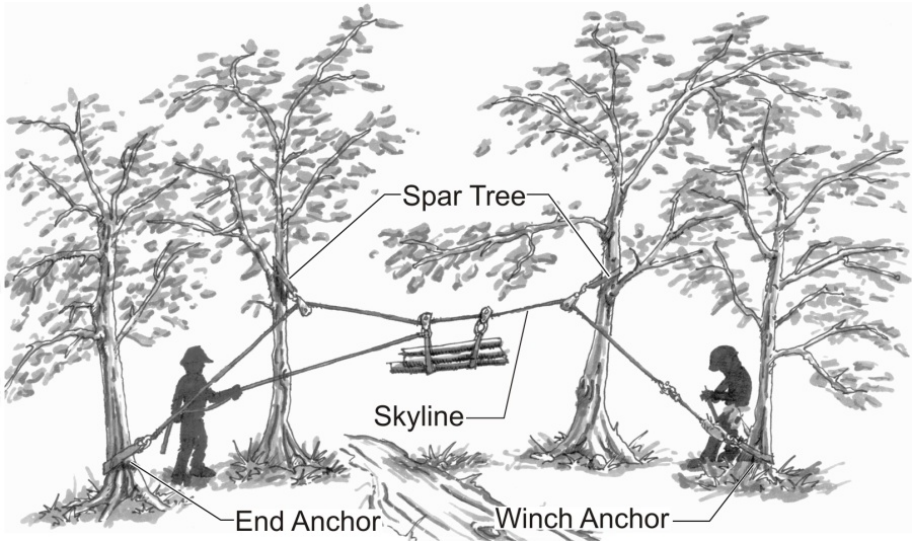


Figure 6.22 – Cable Winch Rigging System

Rigging systems can be set up in many ways. A wire rope is anchored at two trees. The *cable winch* (the most commonly used is Griphoist brand) *Griphoist* at one end, known as the *winch anchor*, augments the power of a trail worker to pull the slack out of the wire rope, in between the *spar trees*, lifting the load off the ground.

When determining where to place the rigging, make sure to analyze the layout, the intended payload, and placement of rigging before you proceed. A well placed *skyline* and *anchors* would put vertical force on the *spar trees*, so not to topple the trees from diagonal or horizontal pressure. To accommodate such a horizontal pressure will most likely be a *linear layout*, where the four trees are in alignment with one another so that the *anchors* do not lift the *pulleys* off of the *spar tree* adding sideways pressure.

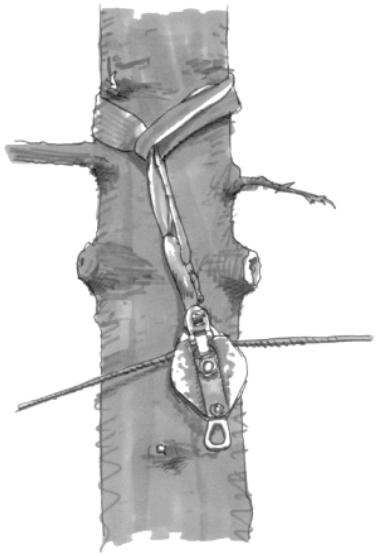


Figure 6.23 – Nylon sling around spar tree with pulley and mainline

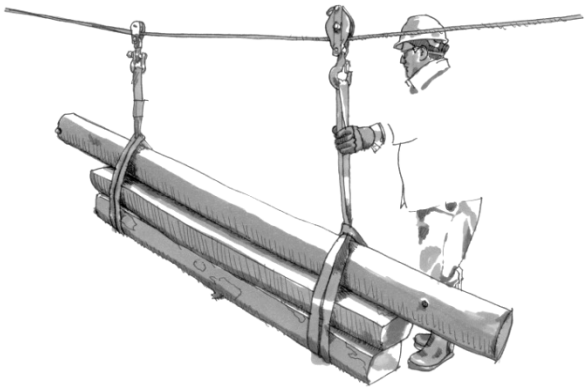


Figure 6.24 – Logs on mainline with slings and pulleys

Figure 6.25 – Logs on mainline with slings and pulleys

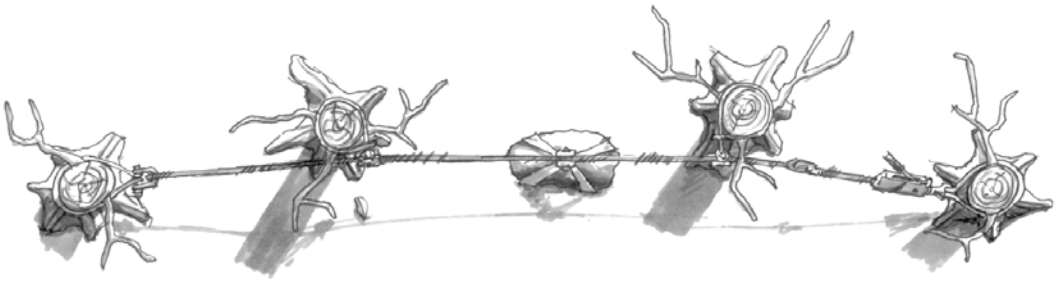


Figure 6.26 – A linear rigging setup

In the event a *linear* set-up does not work use a *guy-line* or two to stabilize the *spar tree*. A *guy-line* is set up to pull the *spar tree* or *anchor tree* in the opposite direction than the *skyline* is pulling the tree in. Use a *sling* and a *cable* (chain would work as well) and fasten it to the same area of the tree as the *skyline* cable is wrapped. If the tree is being pulled in multiple directions, such as in a set up where a *non-linear rigging* pulls a *spar tree* in separate directions then two *guy-line*s may be necessary.

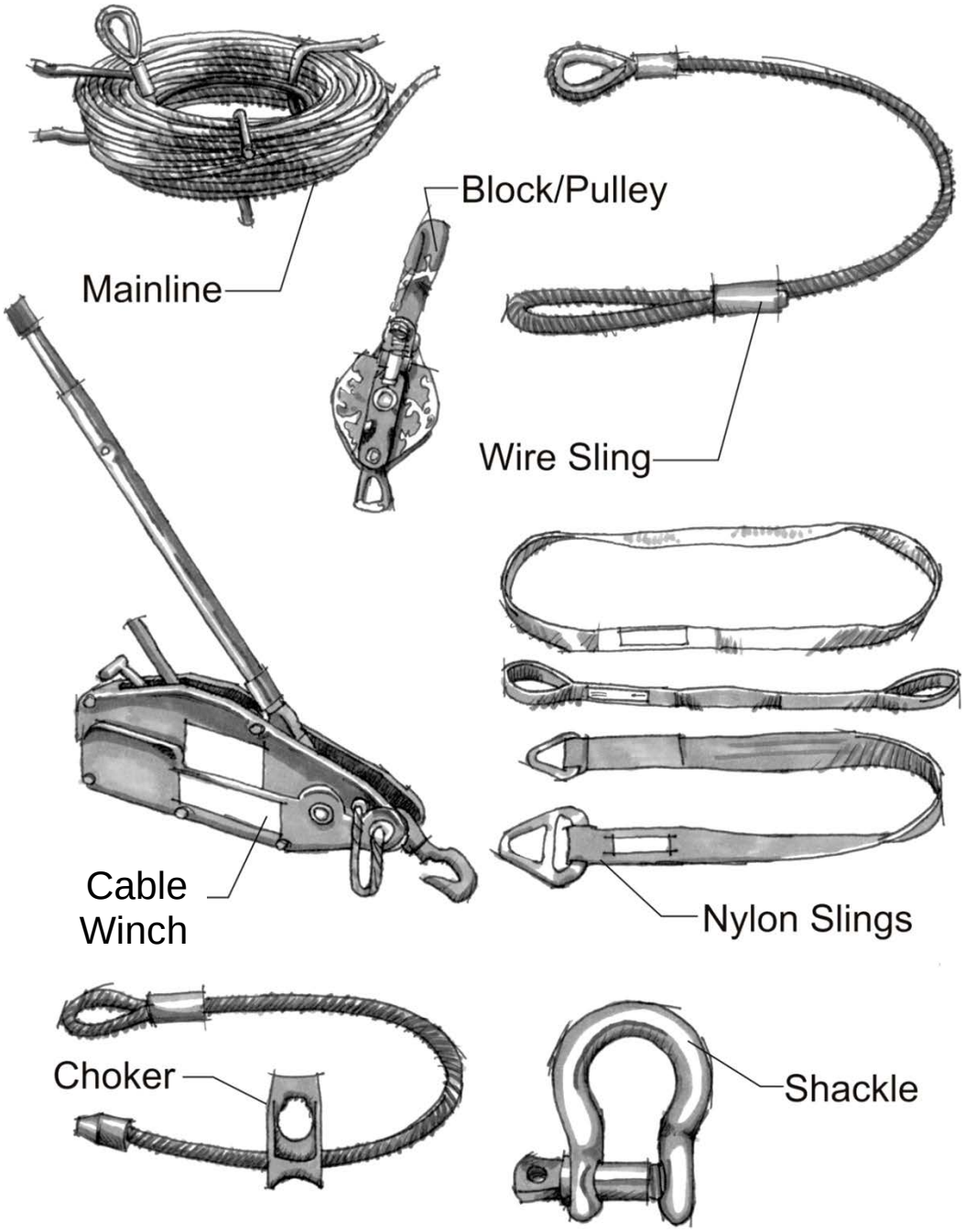


Figure 6.27 – Cable Winch and Common Accessories

6.5 The Alaskan Saw Mill

An ***Alaskan saw mill*** is a great tool for wood workers, builders, and outdoorsmen, giving them a way to turn a chainsaw into a lumber making machine. Whether milling beams in a remote site for a cabin, or harvesting wood for a puncheon, the *Alaskan saw mill* is a versatile tool.

Prepare the First Cut

Set up the *guide rails*, these rails are what the mill rides on when making its first cut. Rails provide a flat and smooth surface that guides the mill. The *guide rails* should extend past the ends of the log so the mill can begin and end the cut consistent with the support of the guide rail. Use two long 2x4s or 2x6s, with *guide rail* brackets made of steel and nailed on the ends of the log to support the wood rails.

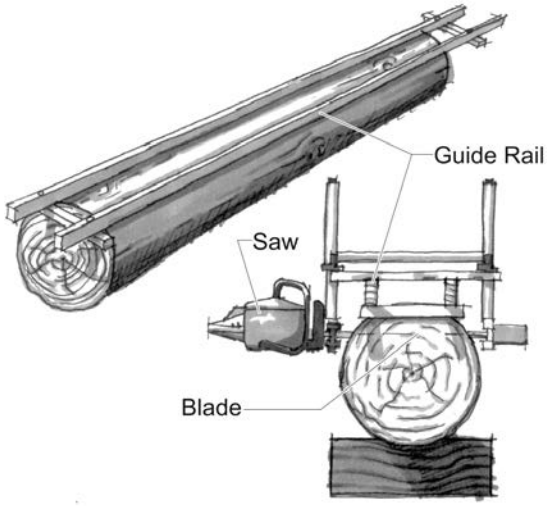


Figure 6.28 – Alaskan Saw Mill: 1st Cut

As you set up the rails, consider the log's taper and any other feature you wish to avoid or highlight. The first cut will determine the foundation from which the rest of the log is milled. Once you begin, it is helpful to insert small wedges in the cut behind the *saw*. Wedges will keep the log from collapsing binding up the saw. When the first cut is complete, the *guide rails* are removed.

The Second Cut

With the second cut, use the surface you just created to support and guide the mill on. If the log is sawn into lumber or beams, the second cut is taken on the bottom of the log. The second cut will then produce a flat surface that is parallel to the first.

If the log is going to be made into partially finished lumber, the second cut can be set below the first at any distance.

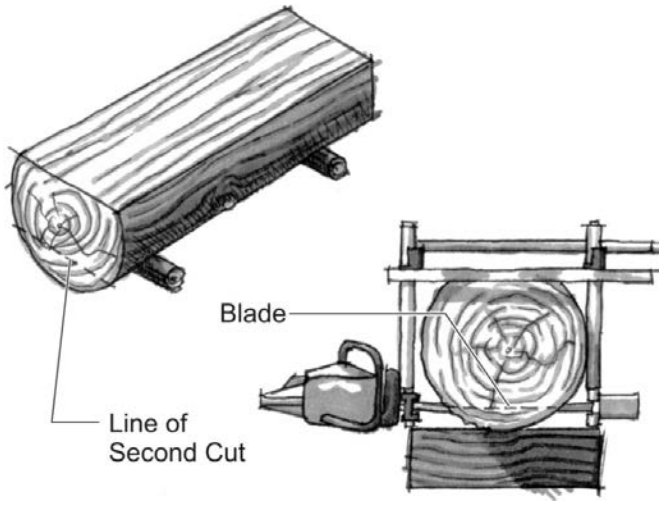


Figure 6.29 – Alaskan Saw Mill: 2nd Cut

The Third Cut

When milling lumber to a finished product turn the log 90º. The *guide rails* are again placed on the top of the log. The rails should be squared with a carpenter's square to insure the sides will be at right angles to each other.

Once this is set up and checked, the third cut can begin. After the third cut is finished, remove the *guide rails* from the top "round," you should have a partially square log with three flat surfaces.

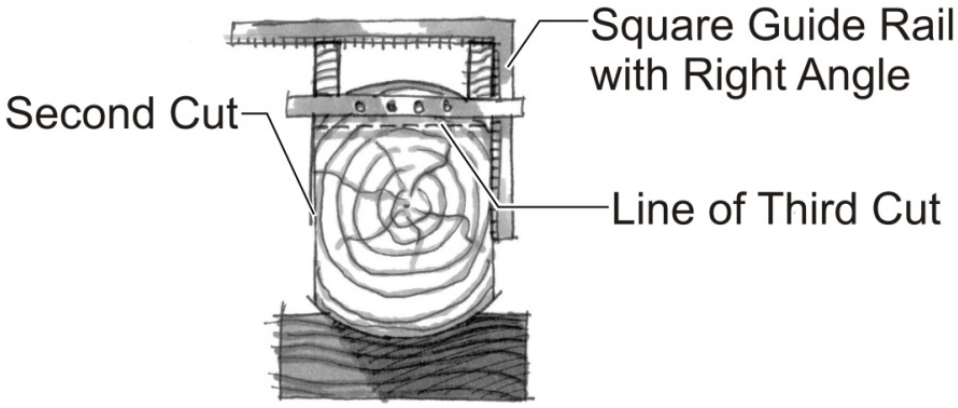


Figure 6.30(a) – Alaskan Sawmill: 3rd Cut

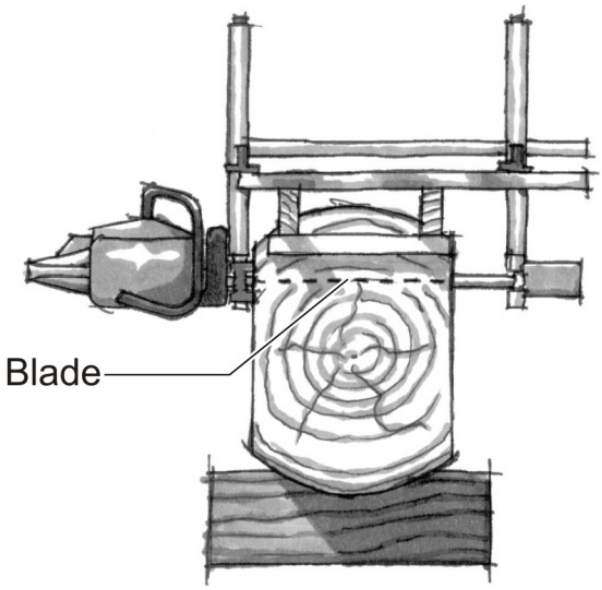


Figure 6.30(b) – Alaskan Sawmill: 3rd Cut

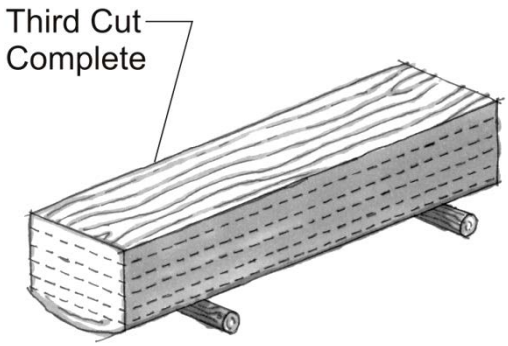


Figure 6.30(c) – Alaskan Sawmill: 3rd Cut

When cutting planks from this point, your mill will be guided by the surface of the cut you just made. Set the depth to the thickness you require and precede cutting boards.

6.6 Plug and Feather Quarrying Techniques

The ***plug and feather*** method of splitting stone involves drilling a series of holes in a desired rock spaced every 6 to 12 inches apart. As the thickness of the stone thins it will b**ec**ome important to narrow the gap to ensure the control of the split. The diameter of the hole ranges for 1/2 inch to 1 inch and at least 4 inches deep. When a *gas-powered drill* is not available the holes can be drilled using either a single bladed plug drill or a star drill. The drill is struck by a *hammer*. The stone dust building up in the hole is removed using a tool called a spoon. Once the holes are drilled, two shims called *feathers* are placed in the hole and a wedge called a *plug* is placed between the two *feathers*.

Figure 6.31 – Plug and Feather Quarrying Technique

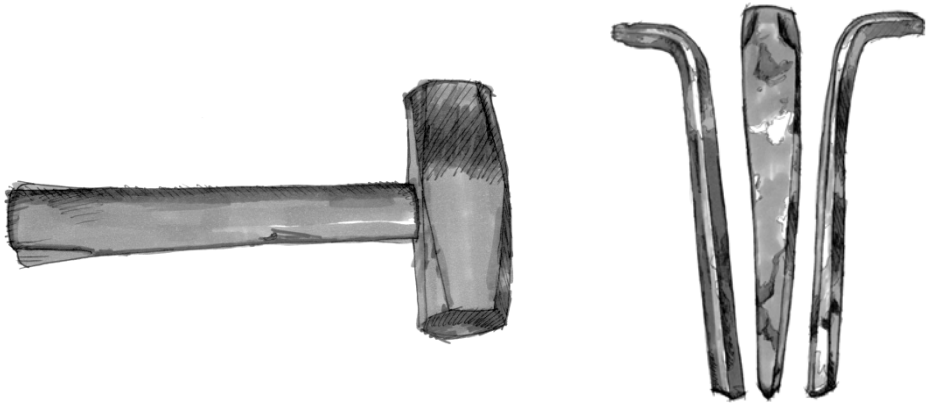


Figure 6.32 - A Plug and Feather Hand Splitting Tool Set: 8lb Double Jack and Two Feathers (Shims) with Plug (Wedge)

6.7 Trail Machinery (Adapted from USFS *Mechanized Trail Equipment*)

Excavator

Excavators come in a wide variety of sizes. Excavators have an earth-moving bucket attached to a boom which allows them to dig and scoop. They usually have a blade on the front for trail finishing/smoothing the trail surface. Excavators have wheels or a track system that propels them. Smaller excavators are called mini or compact excavators. These smaller machines often don't have outriggers so are potentially tippy on hillsides with steep *sideslopes* and narrow trails.

Figure 6.33 – Excavator

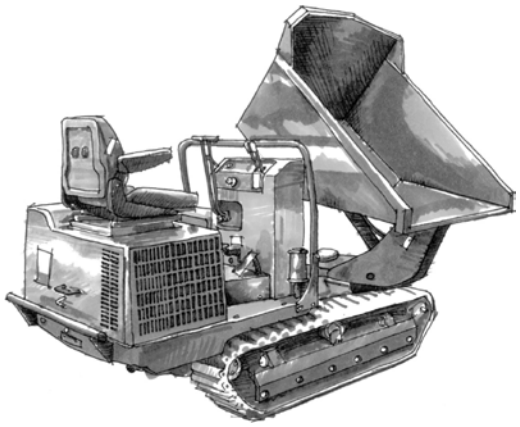


Figure 6.34 – Gravel Hauler

Gravel Hauler

There are many variations of the *gravel hauler*. In general the *gravel hauler* consists of a mechanized *dump bed*, motor, and wheels or track system. There are riding and walk-behind versions. These machines are a way to efficiently move large amounts of gravel, soil, etc.,. Some compact carriers offer a 180 degree swivel dump bed that gets the payload into the area of the trail difficult to achieve with minimal hand-work.

ATV Belly Dump

With a narrow profile a *belly dump* can get into areas skid steers cannot with minimal impact. It features an adjustable gate which allows it to haul materials ranging from sand, shale and gravel all the way up to eighth inch pit run. The gate can be tripped electronically or manually and requires very little maintenance.

Figure 6.35 – ATV Belly Dump

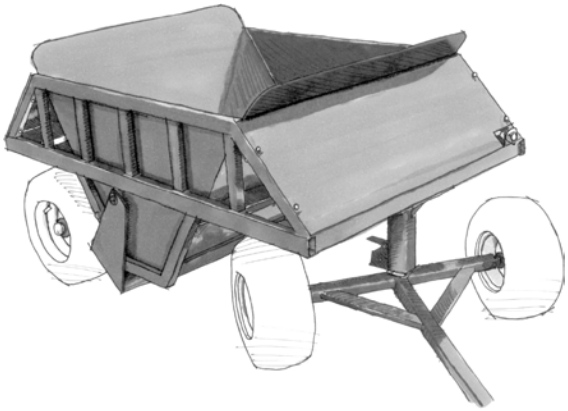


Figure 6.36 – Skid-Steer Loader

Skid-Steer Loader

A *skid-steer loader* is a vehicle maneuvered by skid steering, a method of steering through braking or engaging tracks or wheels on one side of a vehicle. These machines are equipped standard with a front end shovel, although the vehicle has other uses by using different attachments such as forks, tree spades, and compactors. A blade attachment makes it suitable for trail work. The skid-steering creates significant ground friction so may not be suitable for areas with sensitive vegetation or erodible surfaces.

Trail Dozer

Several manufacturers make small trail-specific dozers. These *trail dozers* make quick work of bench cut trails. Their large blade and pushing power easily move stumps and boulders. They can also use other attachments. Despite their efficiency, they produce fairly wide trails and aren't suitable for *singletrack*. They are also quite expensive.

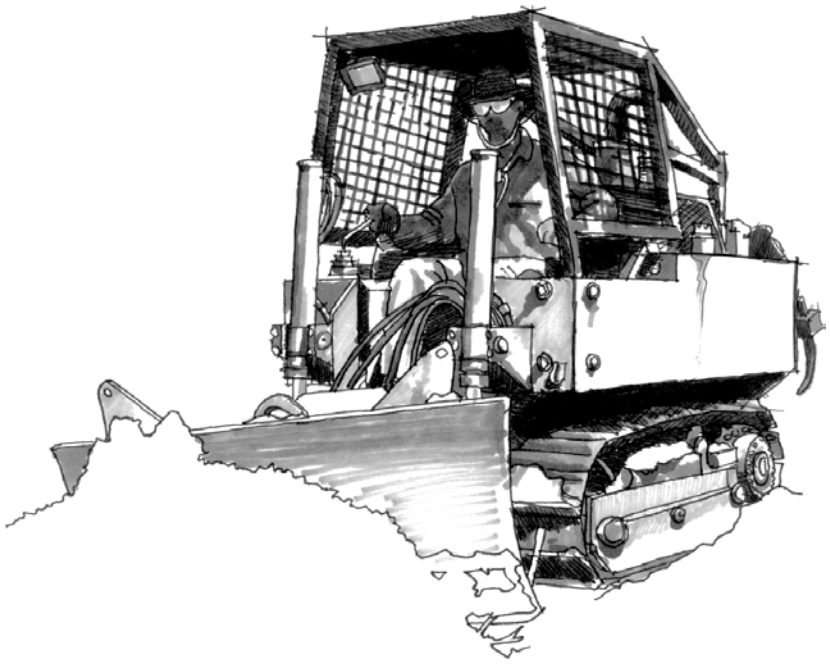


Figure 6.37 – Trail Dozer

A: Standard Trail Structures

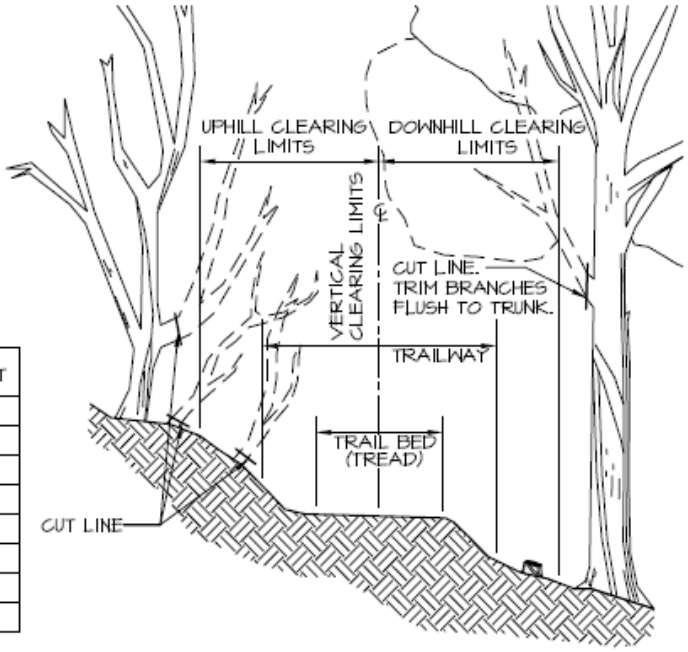
This section contains technical drawings, illustrations, and guidelines for common structures that are used in trail construction. Figures A.1-A.20 have been adopted from the U.S. Forest Service standard trail drawing catalogue, and have been adapted by Ted Kincaid to meet the needs of Alaska State Parks. Figures A.21-A.34 are original artwork by Ted Kincaid.

CLEARING LIMITS

NOTES:

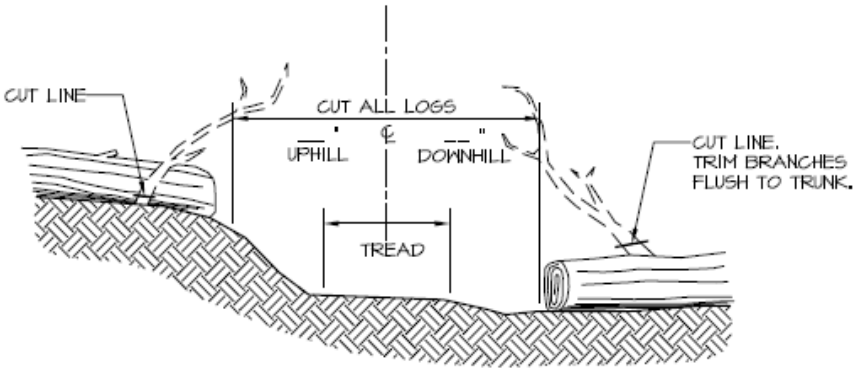
DO NOT REMOVE TREES OVER ___ " DIAMETER IF THEY ARE OVER ___ ' FROM THE CENTERLINE.

REMOVE ALL TREES ___ " OR LESS IN DIAMETER IF THEY ARE WITHIN ___ ' OF THE CENTERLINE.



CLEARING LIMITS (FT)

BEGINNING STATION	ENDING STATION	UPHILL	DOWNHILL	HEIGHT



STUMP HEIGHT REQUIREMENTS* (IN)

STUMP LOCATION	SIDE SLOPE	UPHILL	DOWNHILL
STUMPS BETWEEN THE TRAILWAY AND CLEARING LIMITS.	SIDE SLOPE 10% OR LESS		
	SIDE SLOPE OVER 10%		
STUMPS OUTSIDE THE CLEARING LIMITS.	SIDE SLOPE 10% OR LESS		
	SIDE SLOPE OVER 10%		

*ALL HEIGHTS ARE TO BE MEASURED ON THE UPHILL SIDE OF STUMPS.

NOTE:
DRAWINGS NOT TO SCALE

ADAPTED FROM THE U.S. FOREST SERVICE NATIONAL TRAIL DRAWINGS AND SPECIFICATIONS

BASE DATA MAY HAVE BEEN SLIGHTLY ALTERED

STATE OF ALASKA DEPARTMENT OF NATURAL RESOURCES			
TRAIL DRAWINGS AND SPECS.	CLEARING LIMITS	PREPARED: EMS DRAWN: EMS REVIEWED: XXX DATE: 7/24/10	SHEET	OF 20 SHEETS

Figure A.1 – Clearing Limits

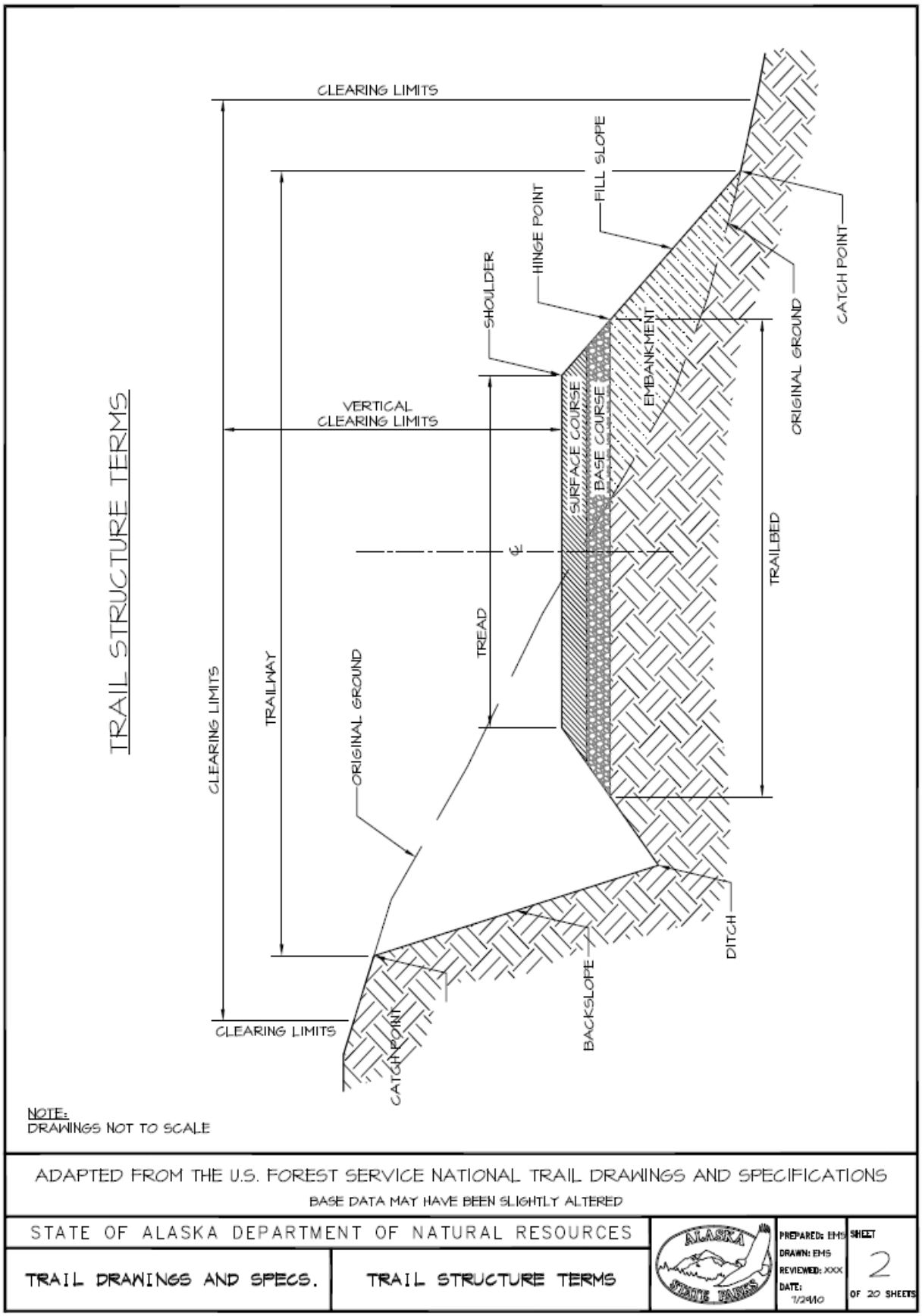


Figure A.2 – Trail Structure Terms

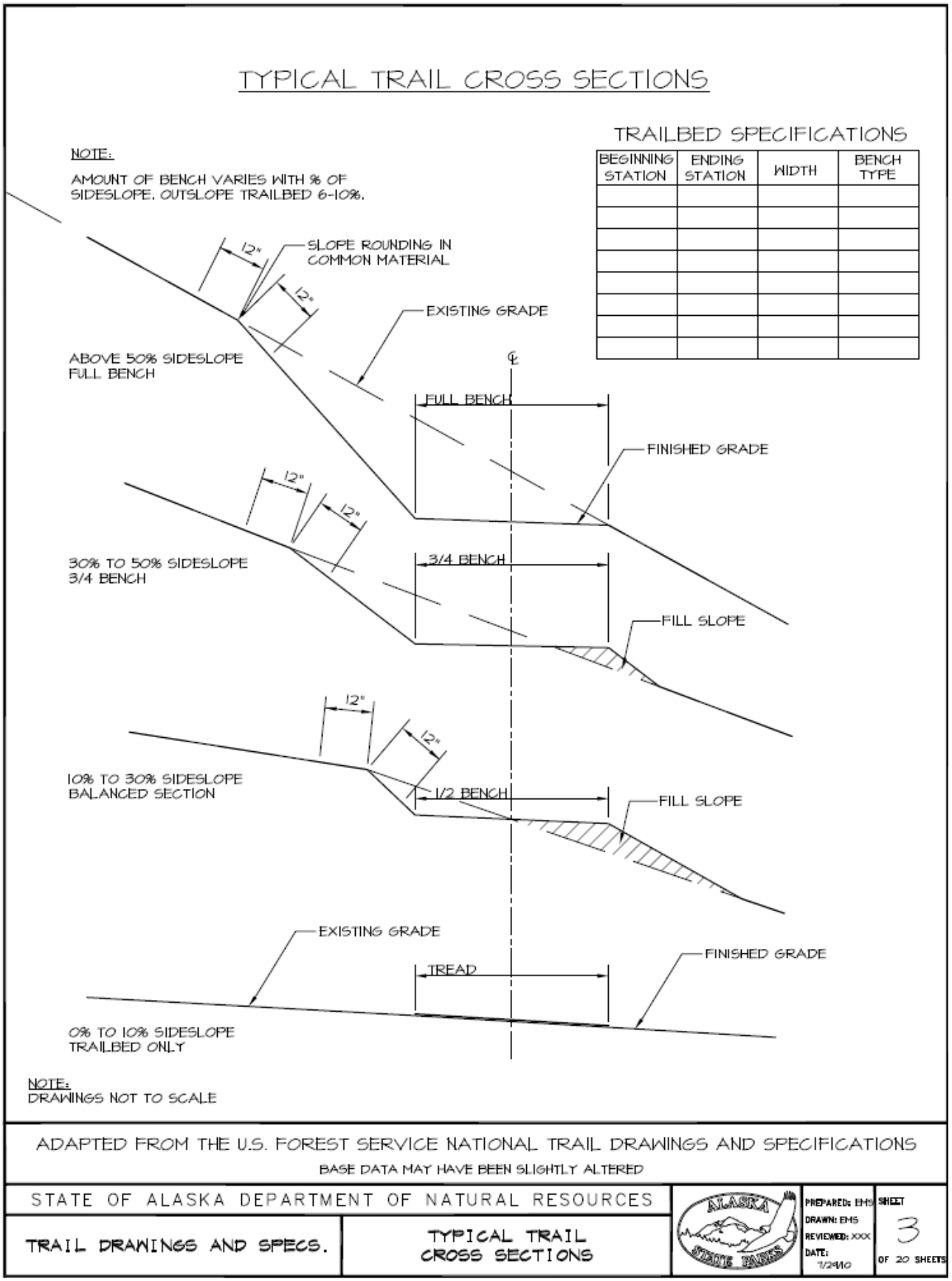


Figure A.3 – Typical Trail Cross Sections

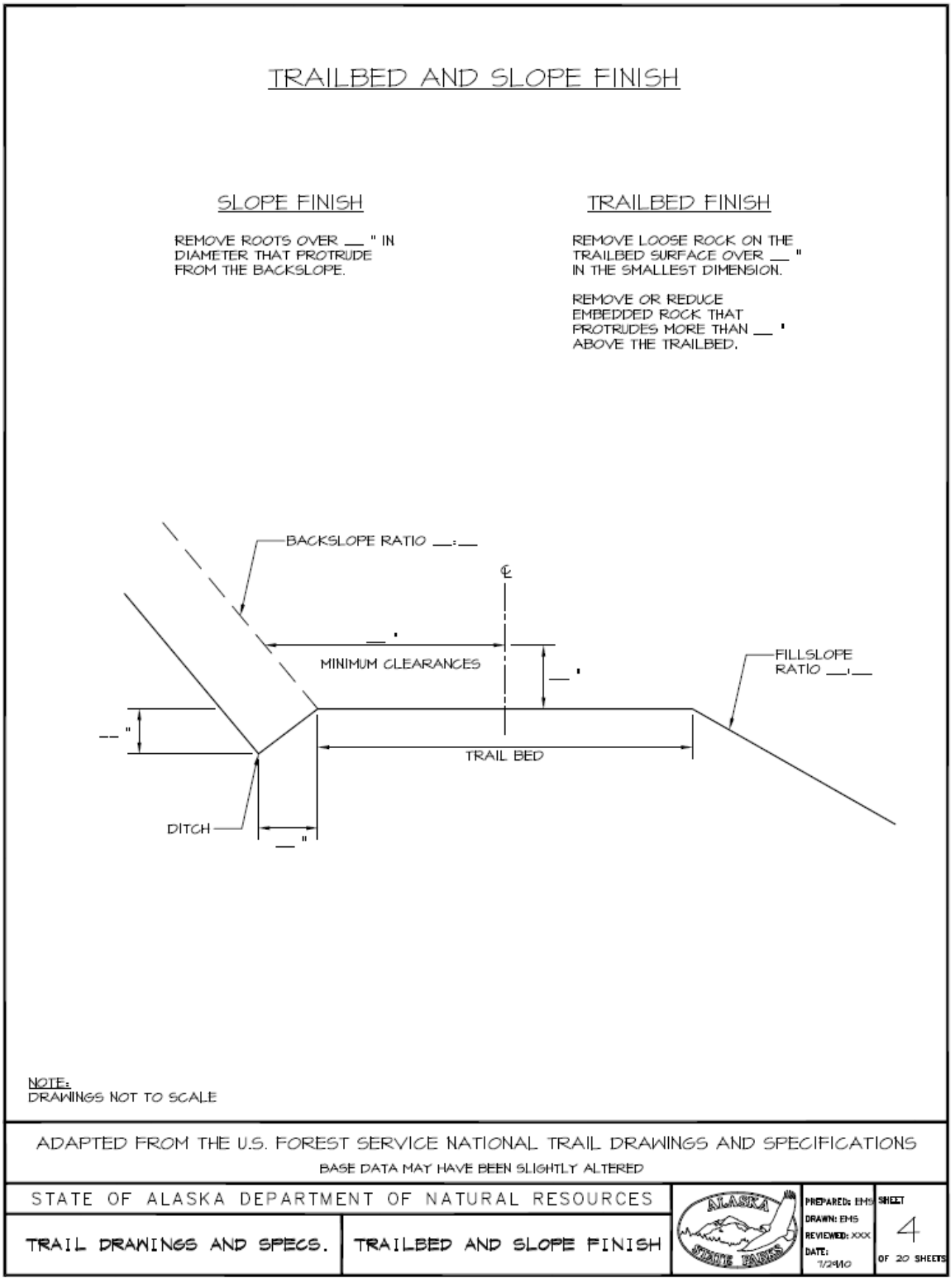


Figure A.4 – Trailbed and Slope Finish

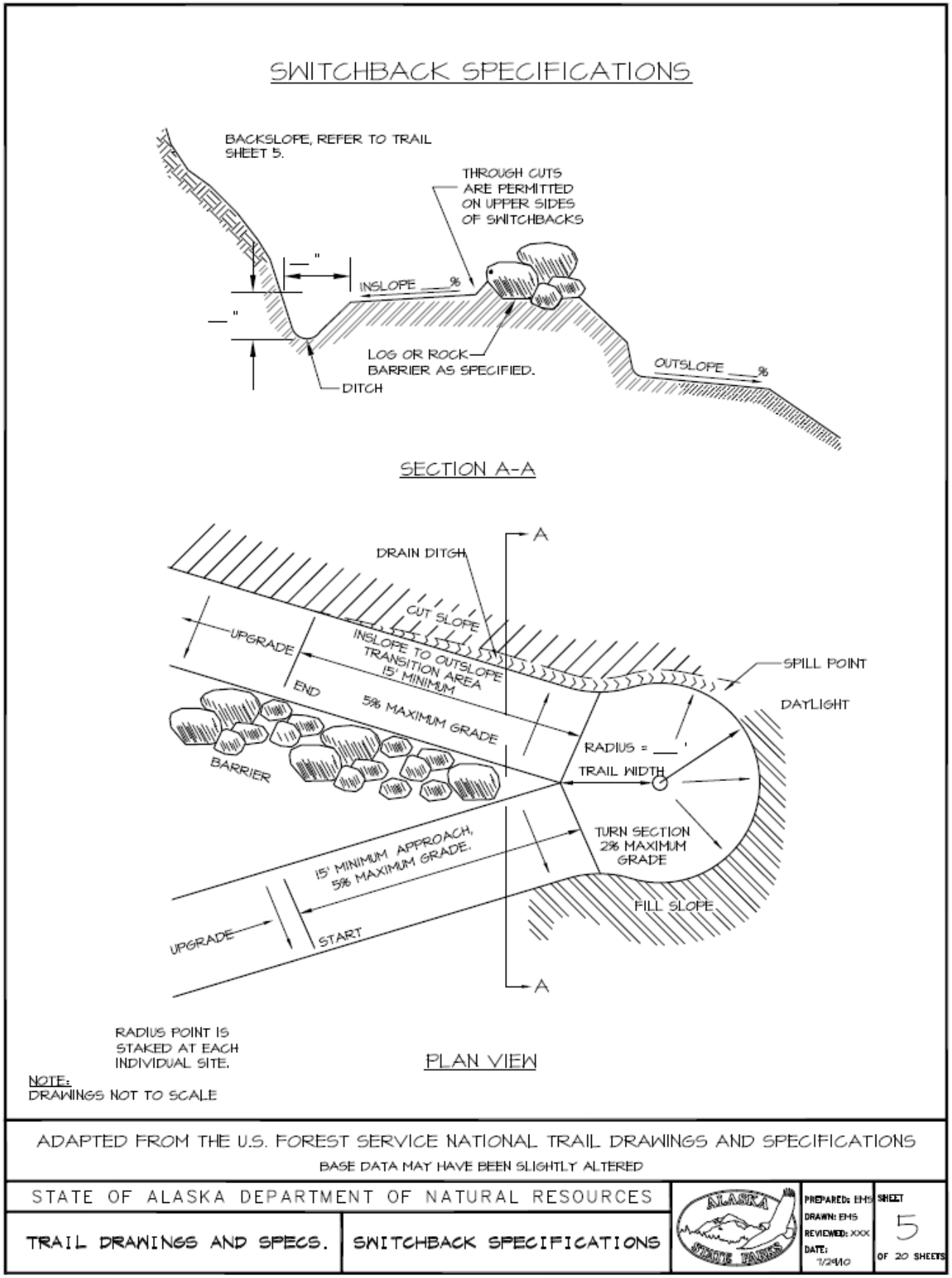


Figure A.5 – Switchback Specifications

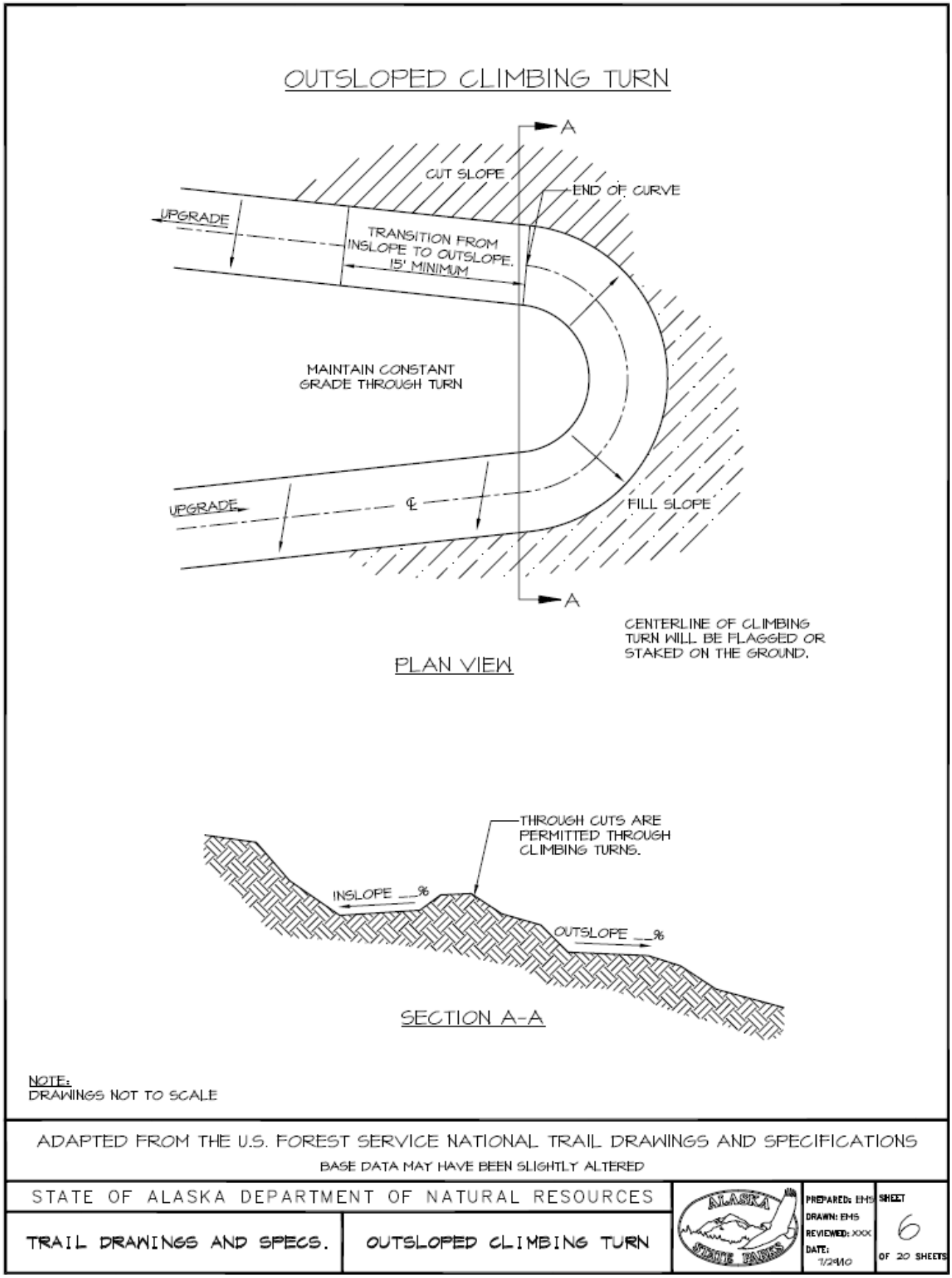


Figure A.6 – Outsloped Climbing Turn

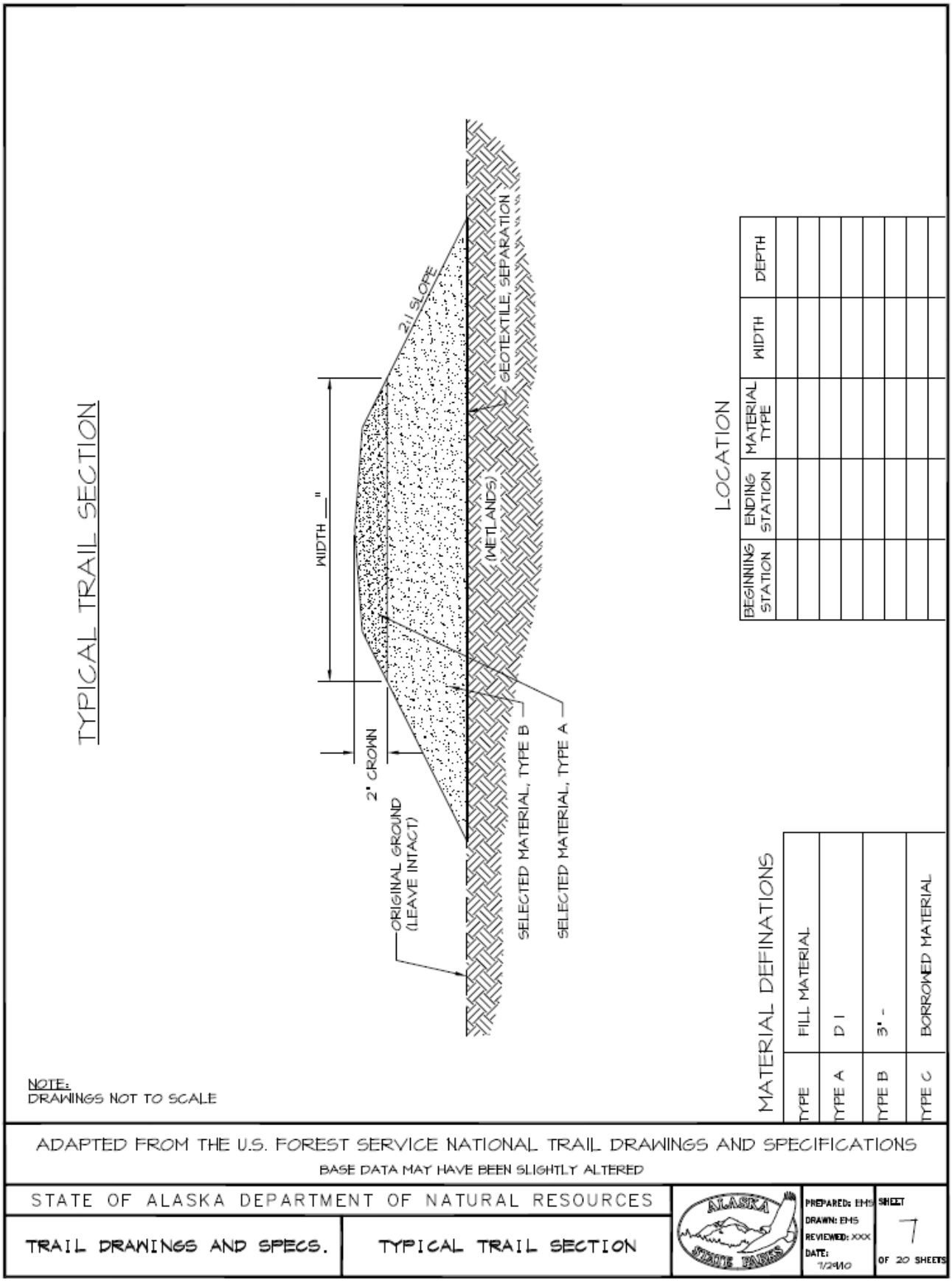


Figure A.7 – Typical Trail Section

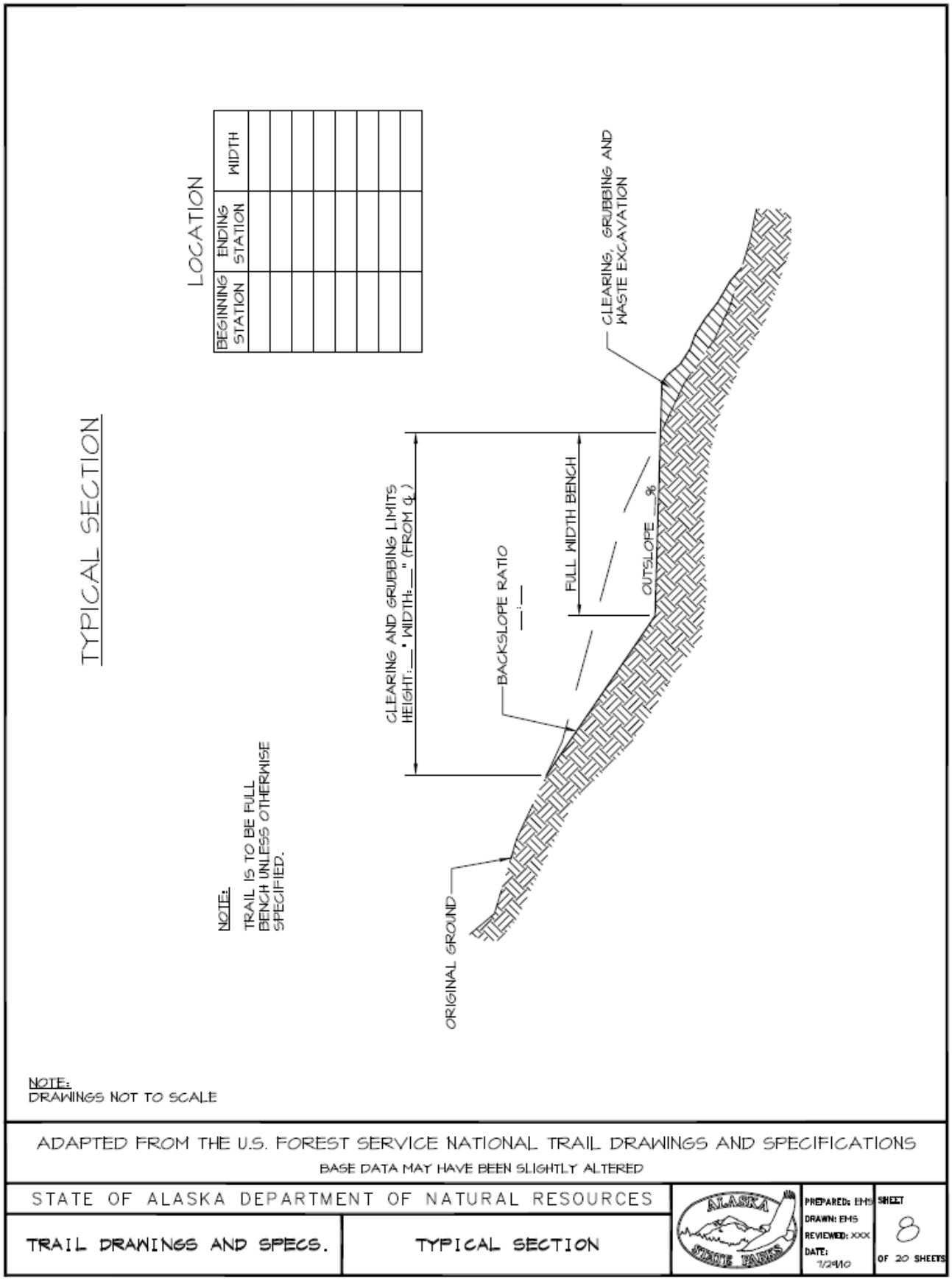
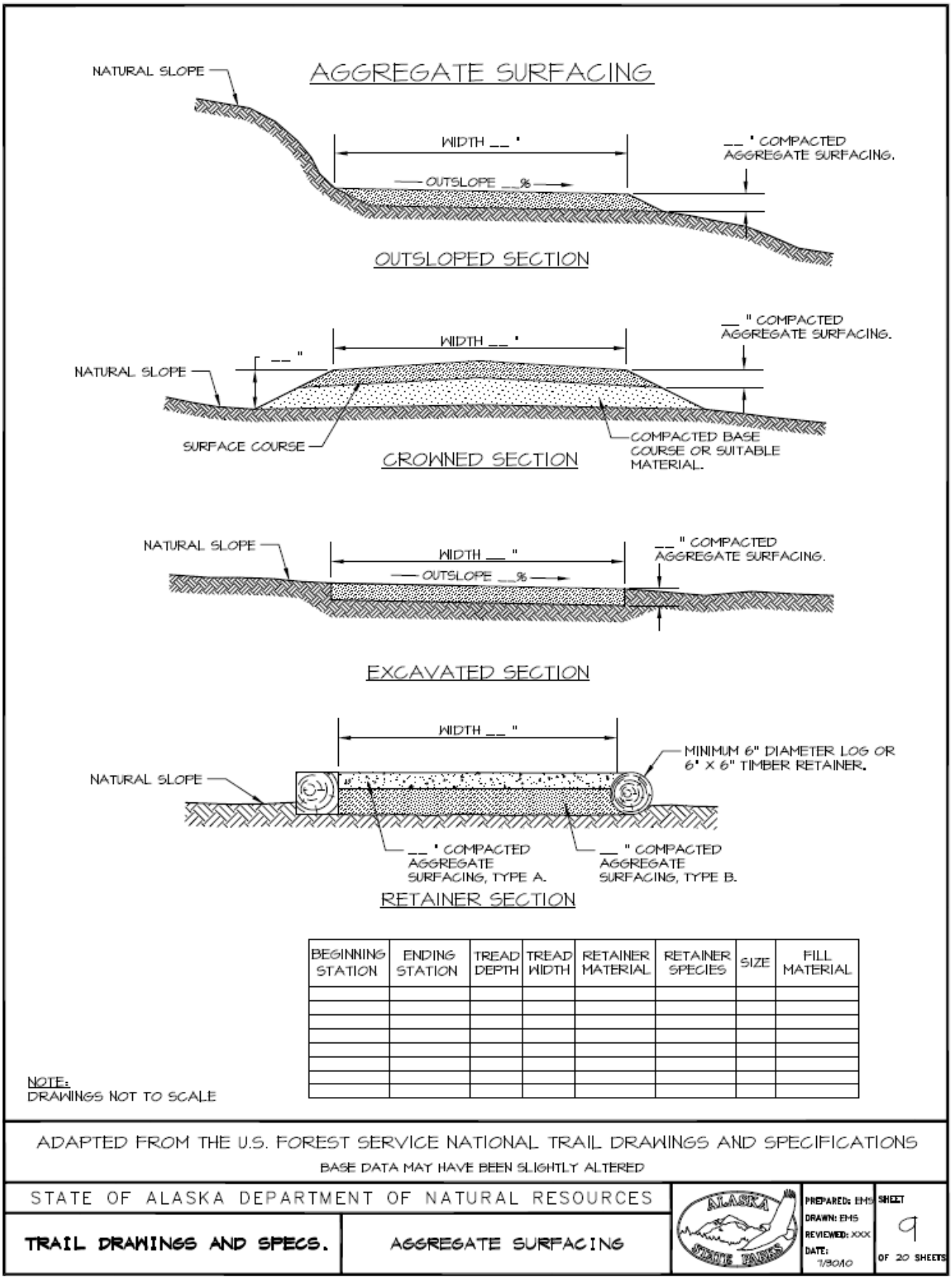


Figure A.8 – Typical Section



BEGINNING STATION	ENDING STATION	TREAD DEPTH	TREAD WIDTH	RETAINER MATERIAL	RETAINER SPECIES	SIZE	FILL MATERIAL

Figure A.9 – Aggregate Surfacing

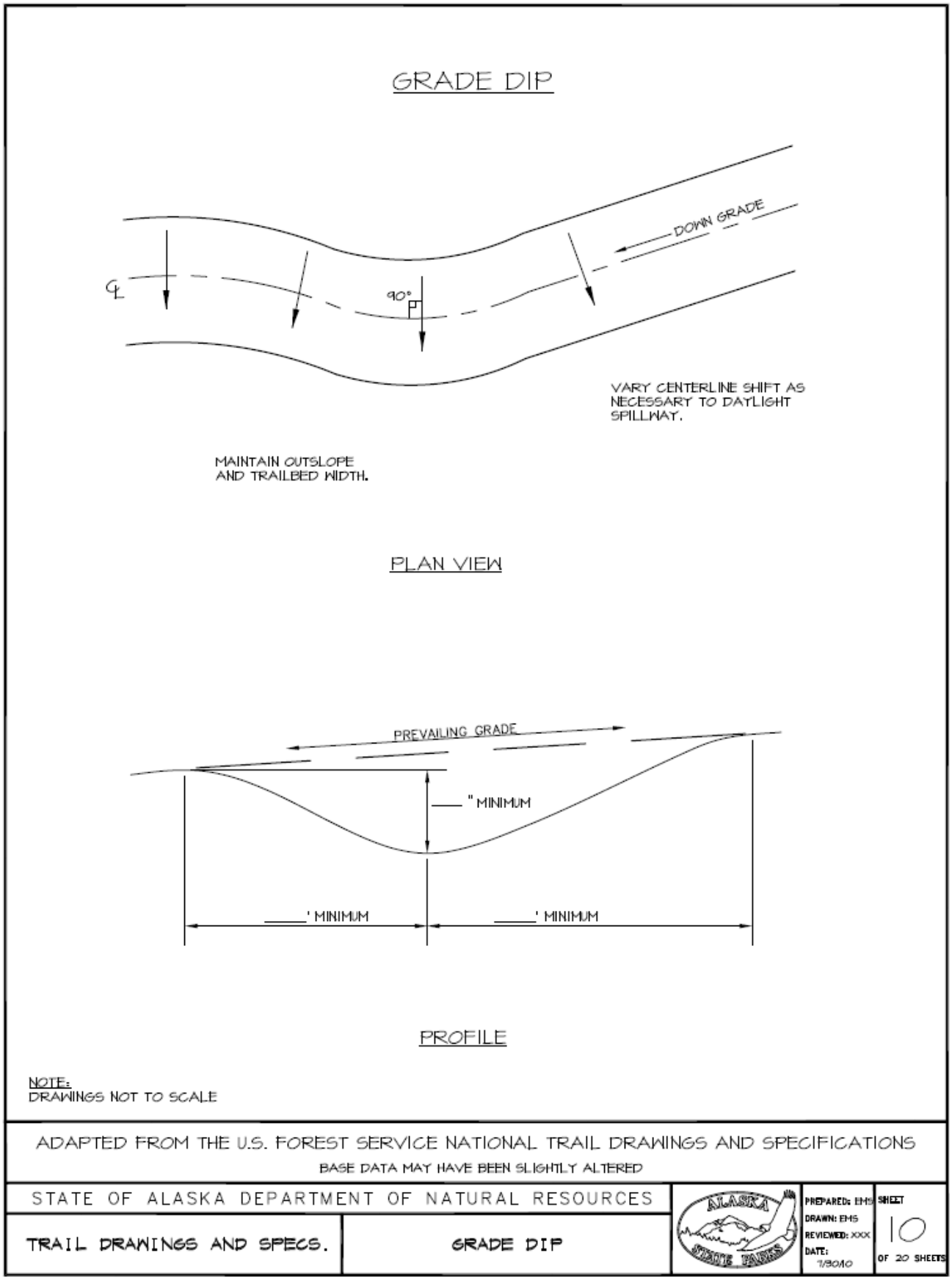


Figure A.10 – Grade Dip

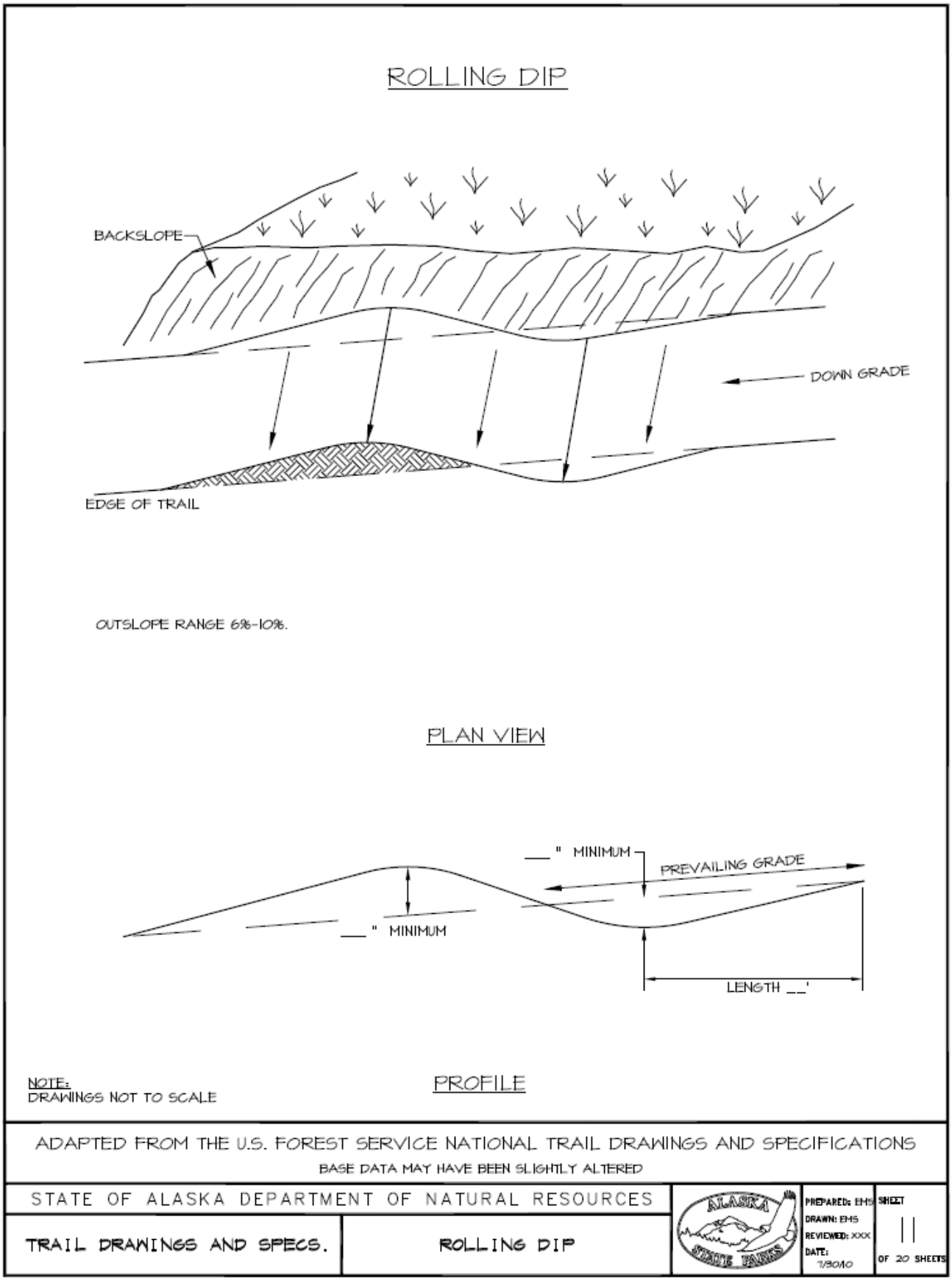


Figure A.11 – Rolling Dip

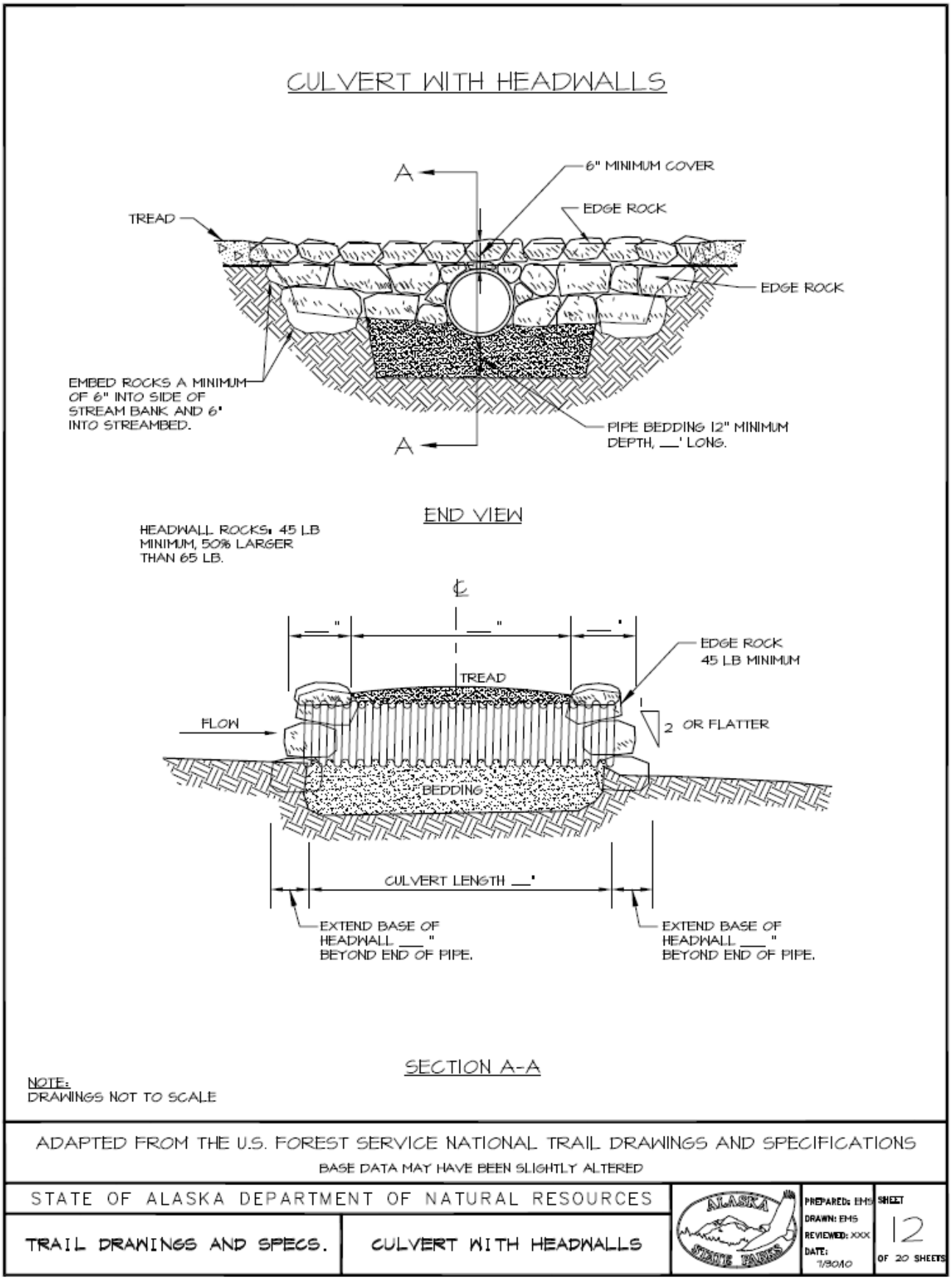


Figure A.12 – Culvert with Headwalls

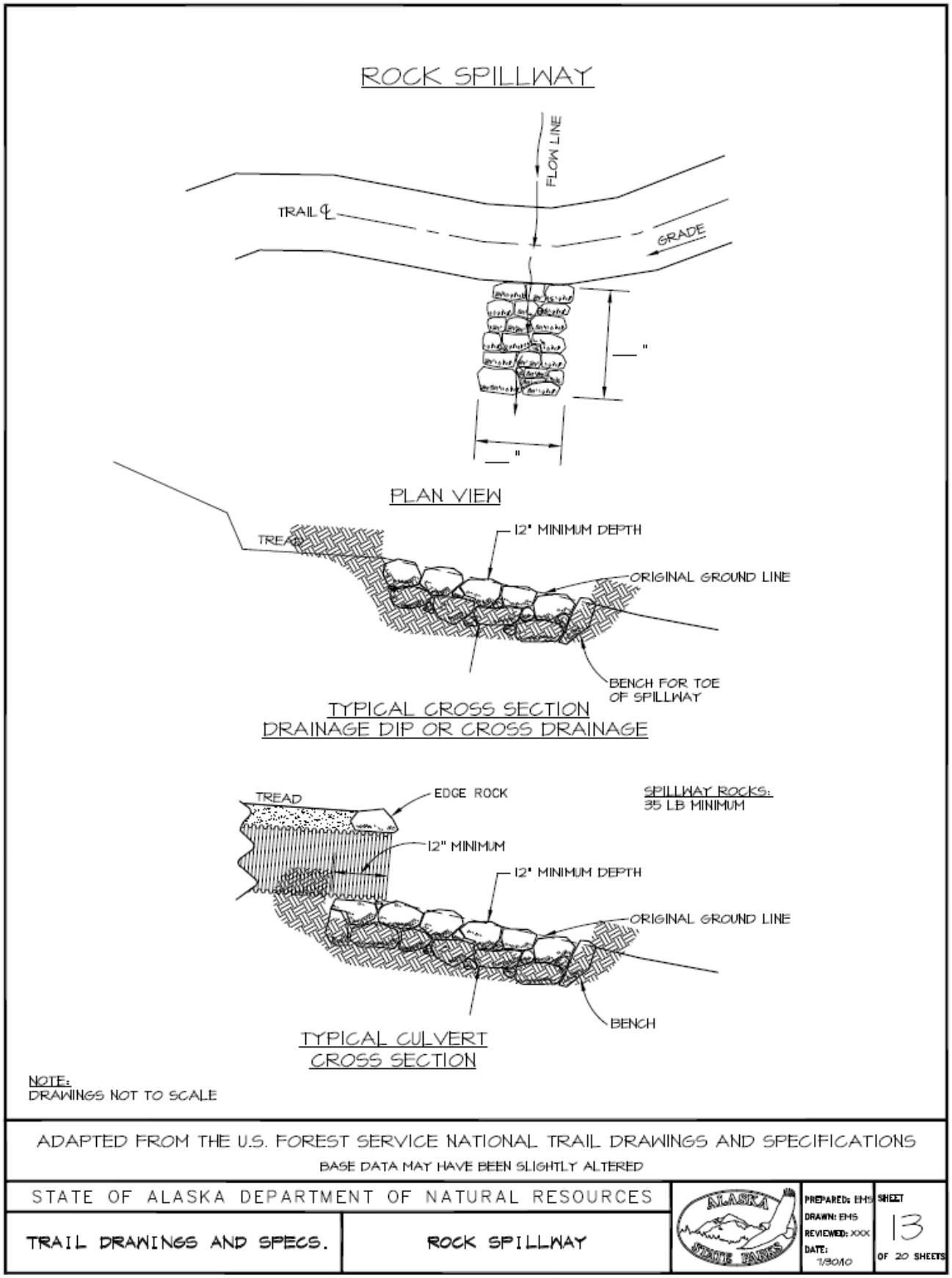


Figure A.13 – Rock Spillway

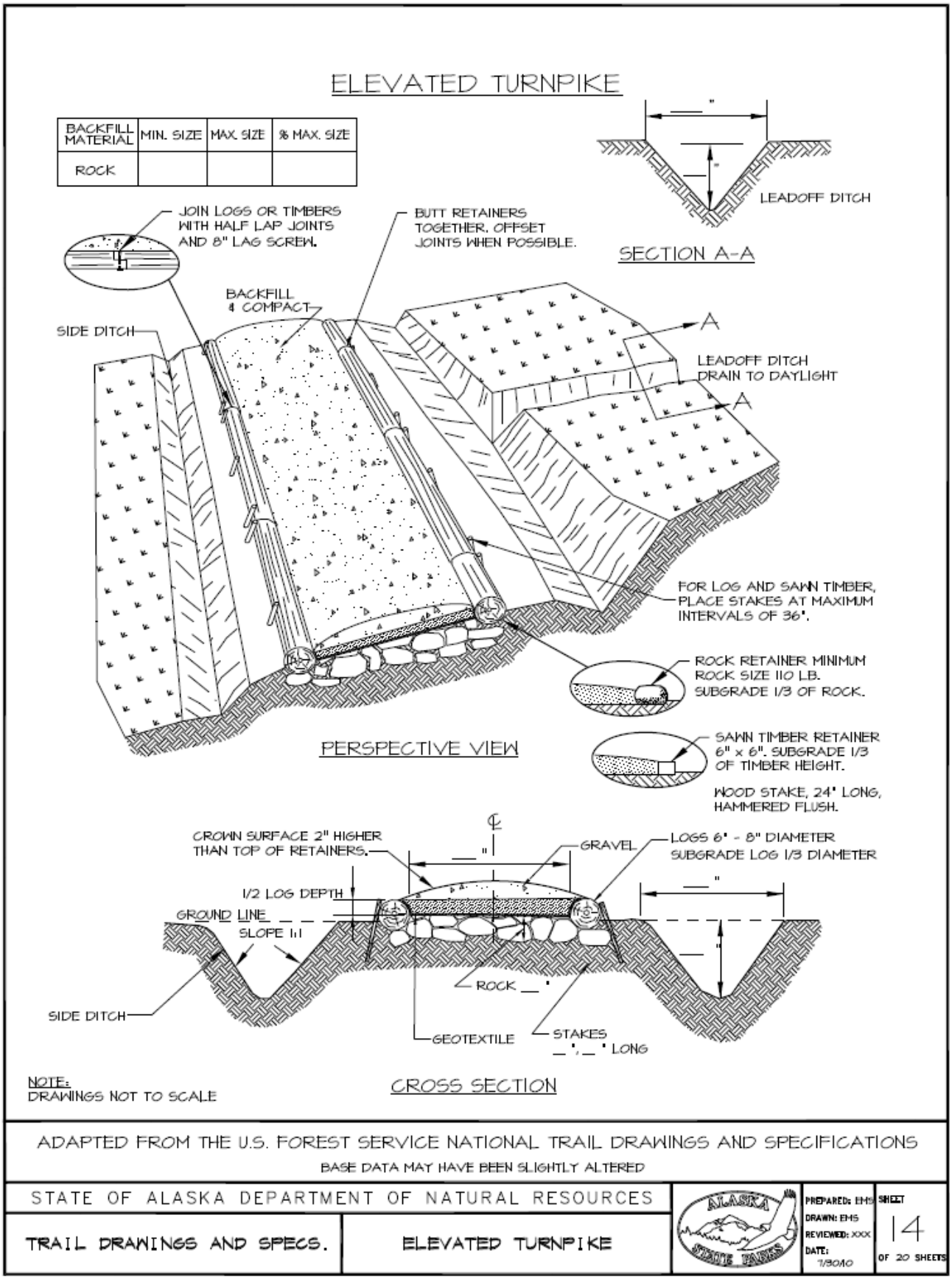


Figure A.14 – Elevated Turnpike

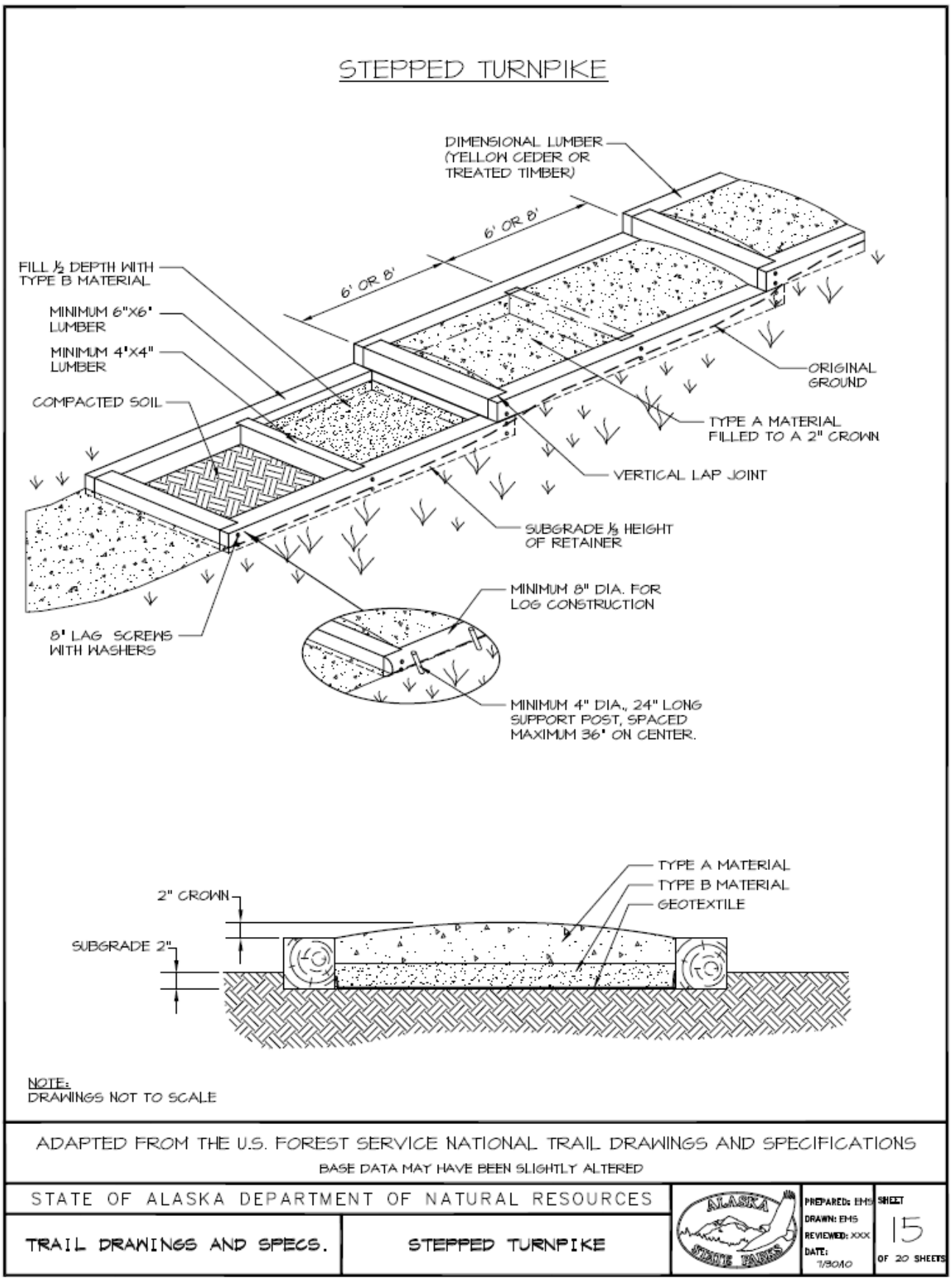


Figure A.15 – Stepped Turnpike

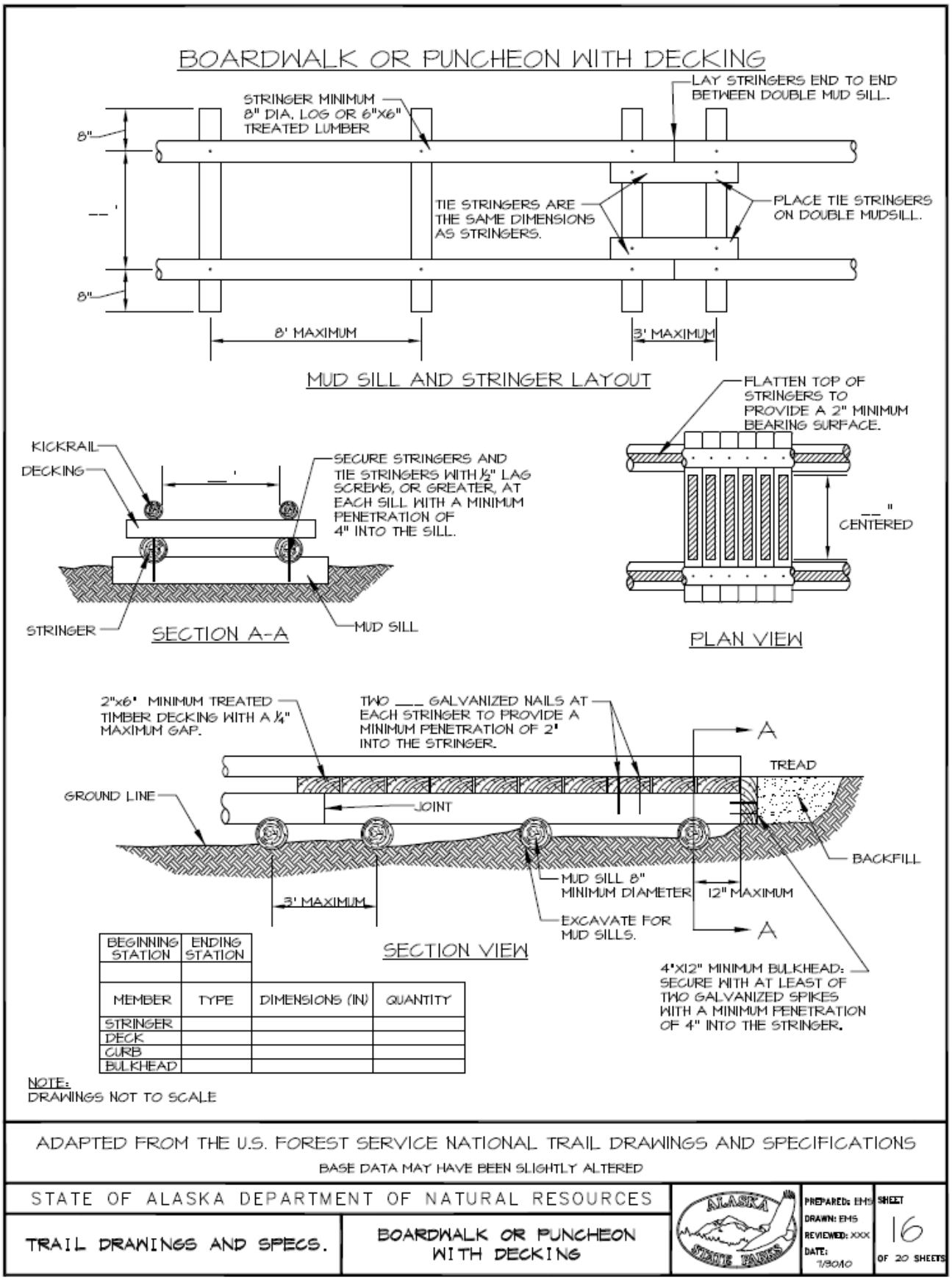
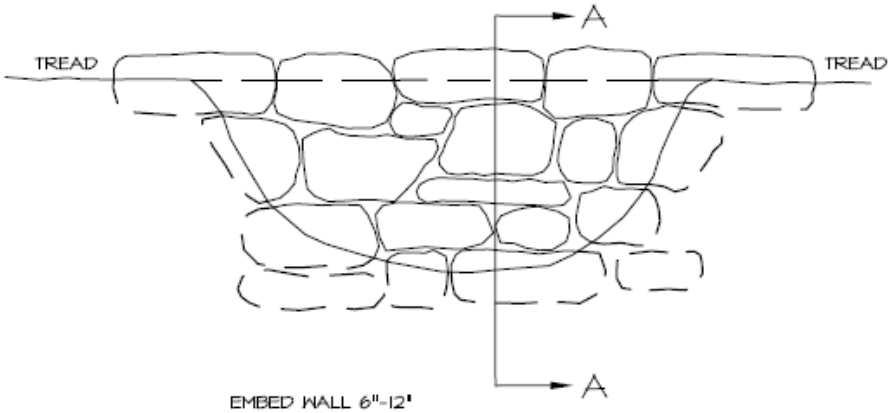


Figure A.16 – Boardwalk or Puncheon with Decking

ROCK RETAINING WALL

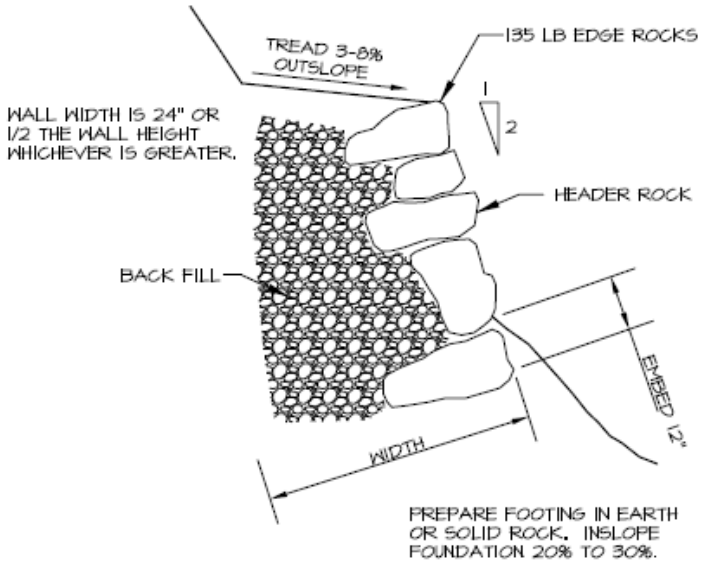


EMBED WALL 6"-12" SIDES AND BOTTOM.

FRONT VIEW

NOTES:

1. USE HIGH AND OUTSIDE CONTACT
2. ALWAYS INSLOPE WALL
3. ALWAYS CROSS JOINTS WITH NEXT LAYER
4. ALWAYS SUBGRADE FIRST LAYER AND SIDES
5. NO OVERHANGS



PREPARE FOOTING IN EARTH OR SOLID ROCK. INSLOPE FOUNDATION 20% TO 30%.

SECTION A-A

WALL SPECIFICATIONS

BEGINNING STATION	ENDING STATION	HEIGHT	WIDTH

NOTE:
DRAWINGS NOT TO SCALE

ADAPTED FROM THE U.S. FOREST SERVICE NATIONAL TRAIL DRAWINGS AND SPECIFICATIONS
BASE DATA MAY HAVE BEEN SLIGHTLY ALTERED

STATE OF ALASKA DEPARTMENT OF NATURAL RESOURCES

TRAIL DRAWINGS AND SPECS. | ROCK RETAINING WALL

PREPARED: EMS
DRAWN: EMS
REVIEWED: XXX
DATE: 1/2010

SHEET 17 OF 20 SHEETS

Figure A.17 – Rock Retaining Wall

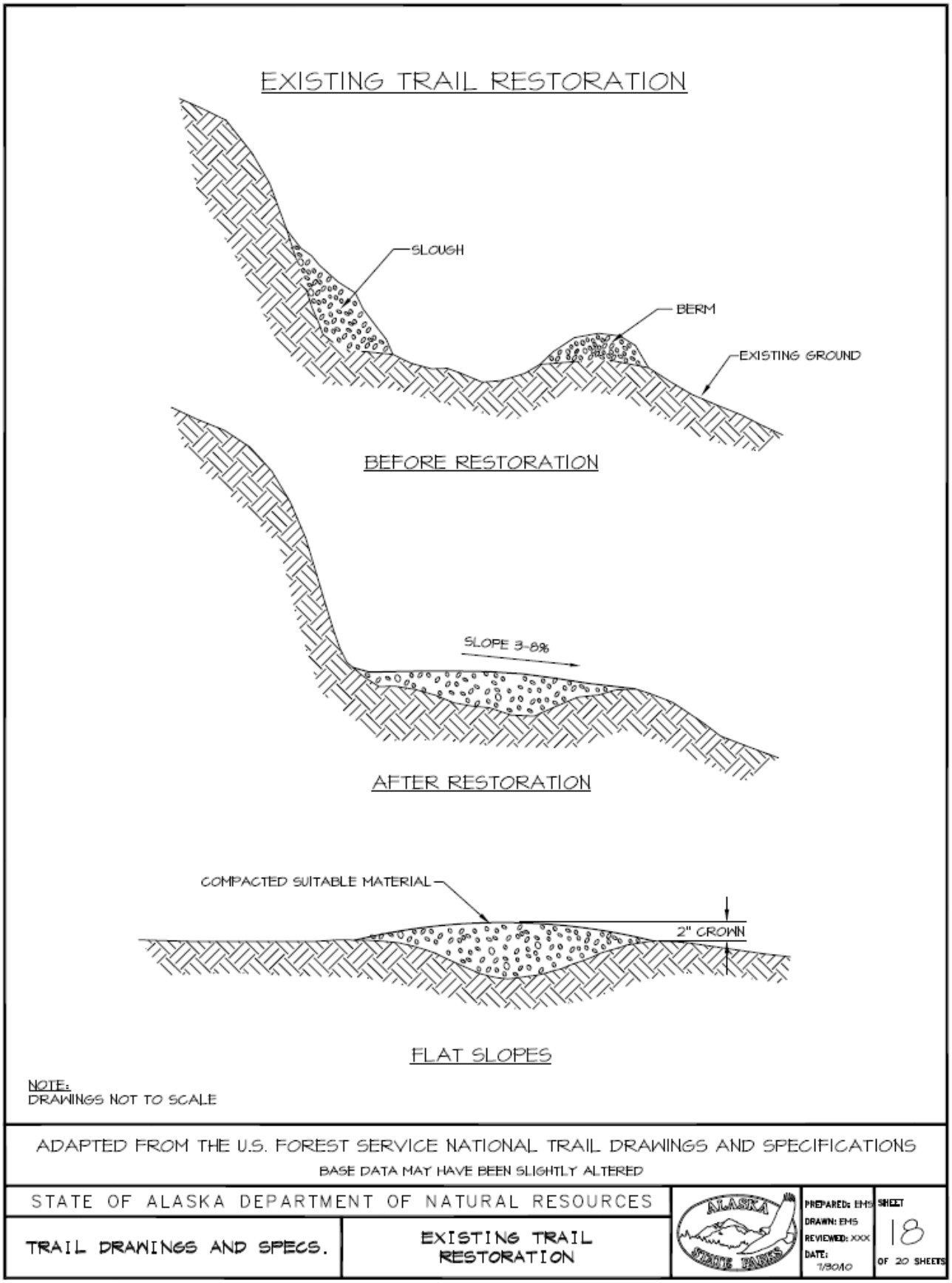


Figure A.18 – Existing Trail Restoration

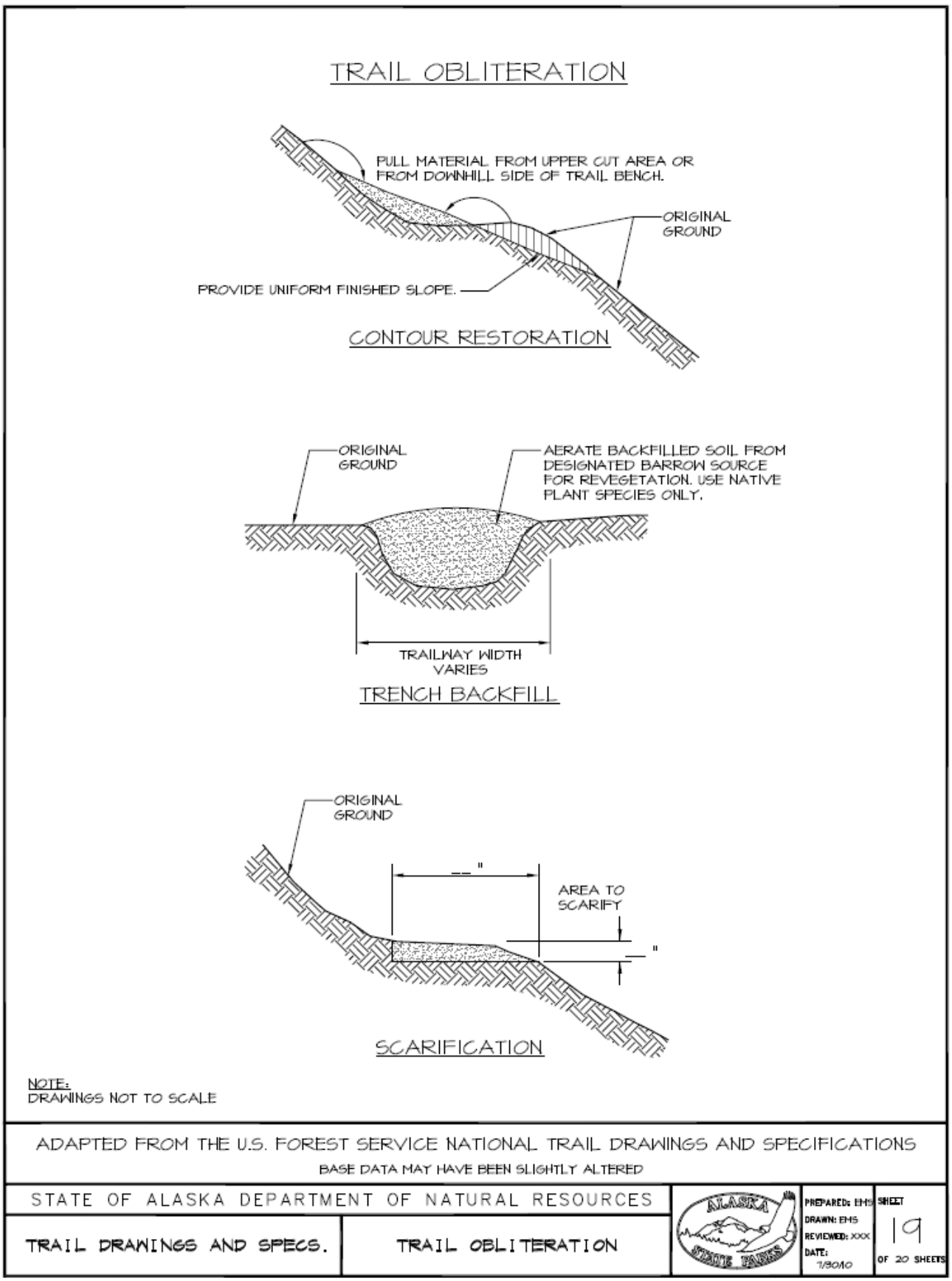


Figure A.19 – Trail Obliteration

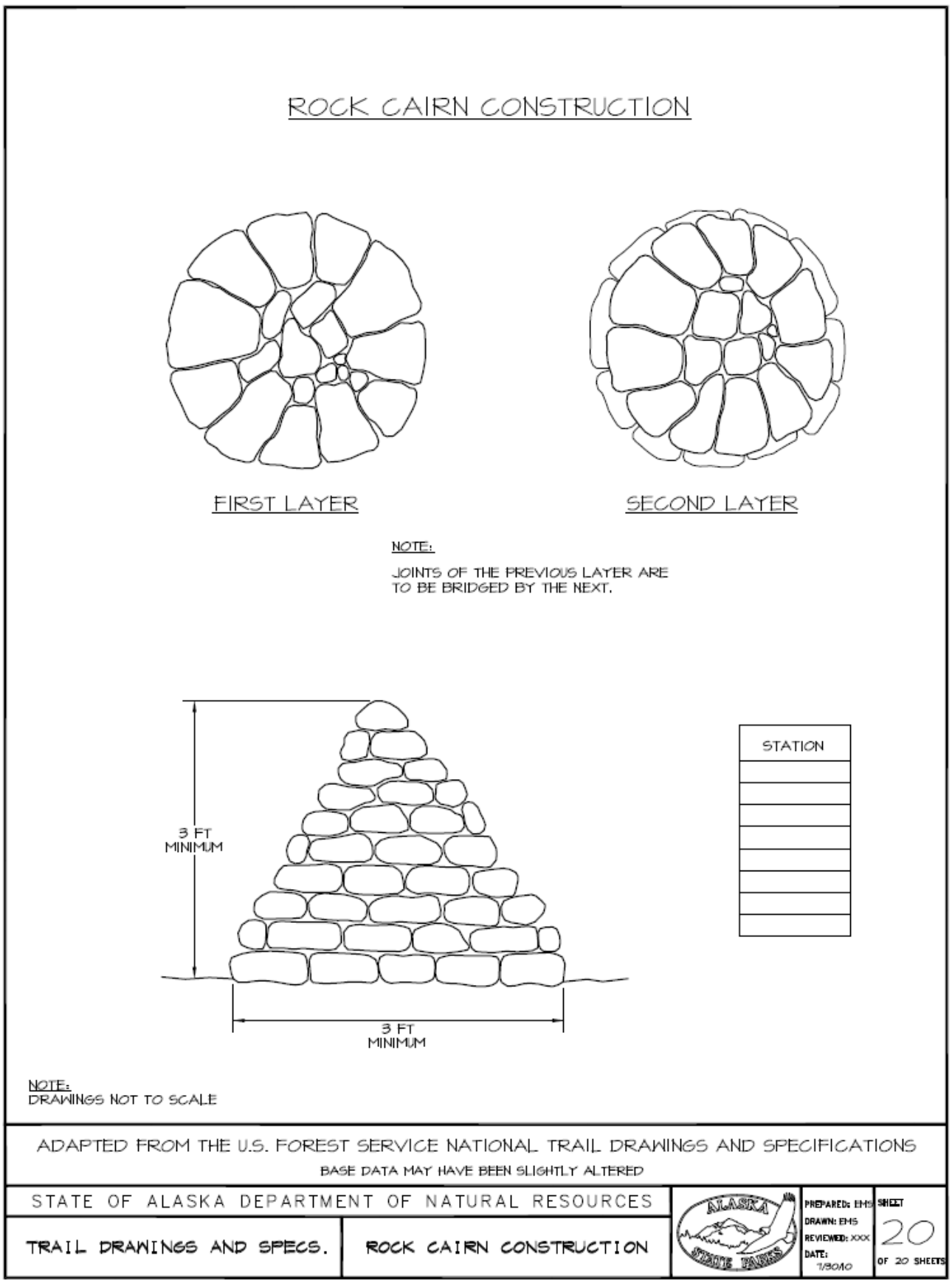


Figure A.20 – Rock Cairn Construction

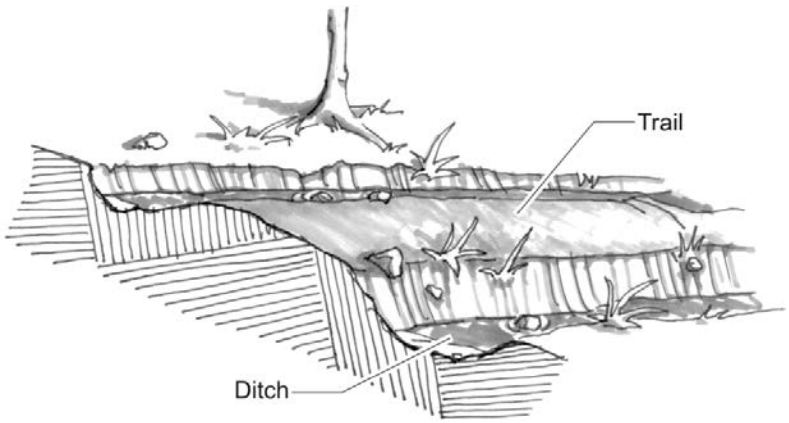


Figure A.21 - Slot Trench Drains and Elevated Trail Tread

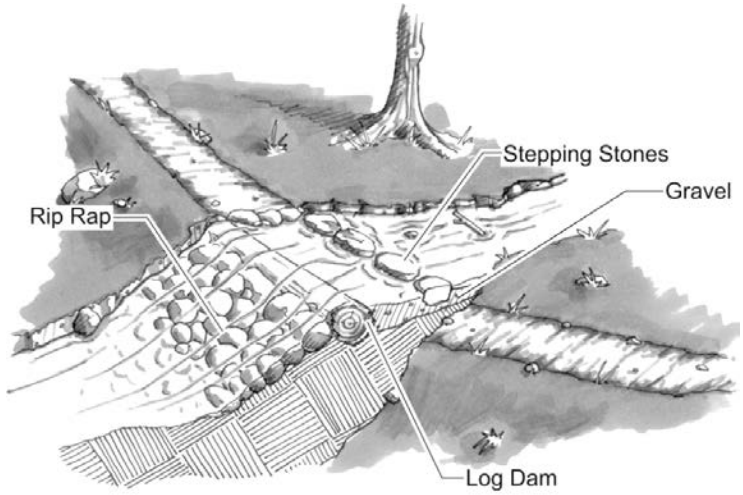


Figure A.22 - Stream Crossings and Stepping Stone Construction

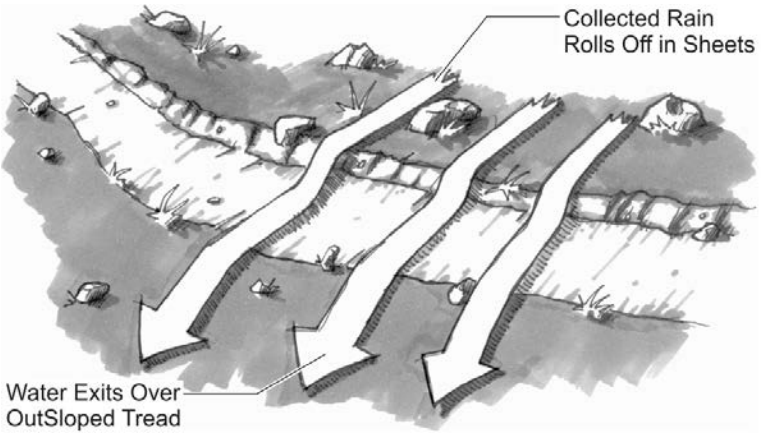


Figure A.23 - Outslope, Grade Dips, and Grade Reversals

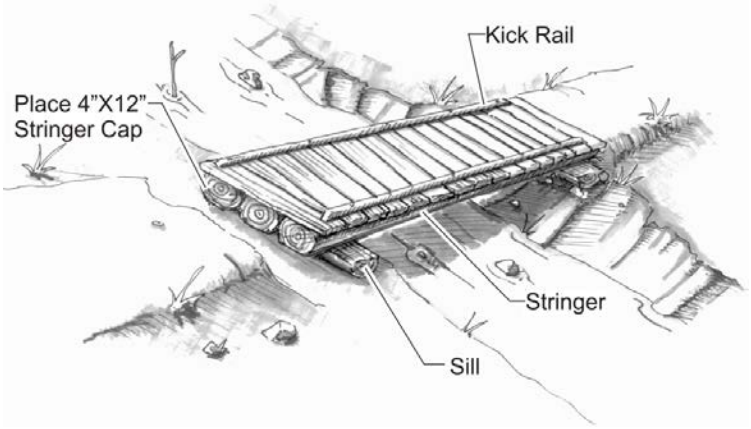


Figure A.24 – Puncheon

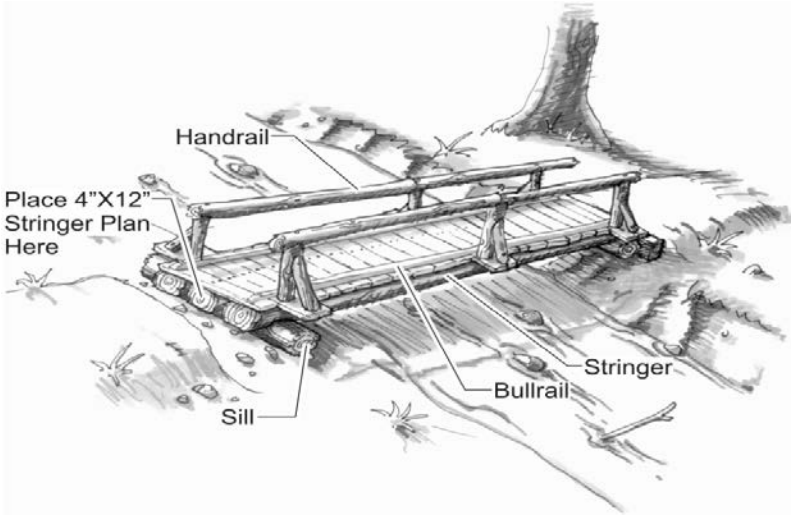


Figure A.25 - Basic Bridge Design Concepts

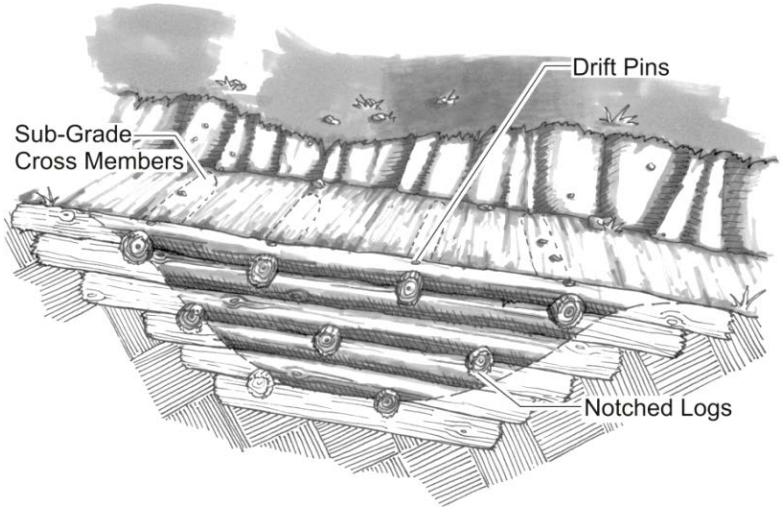


Figure A.26 - Log Crib Walls

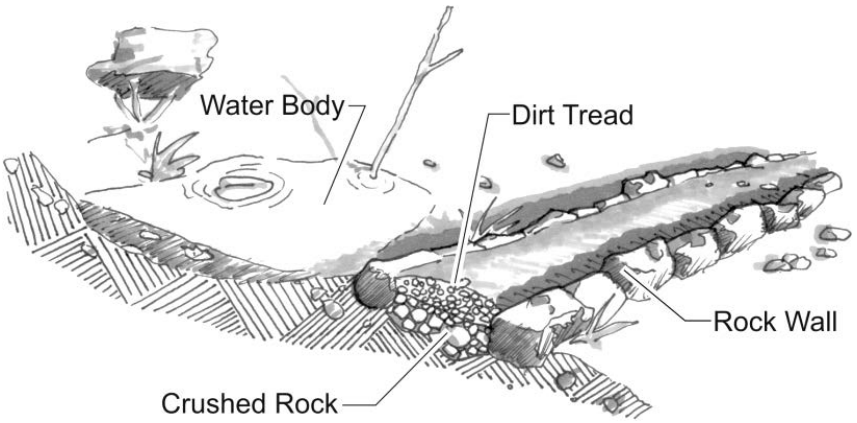


Figure A.27 - Stone Causeway

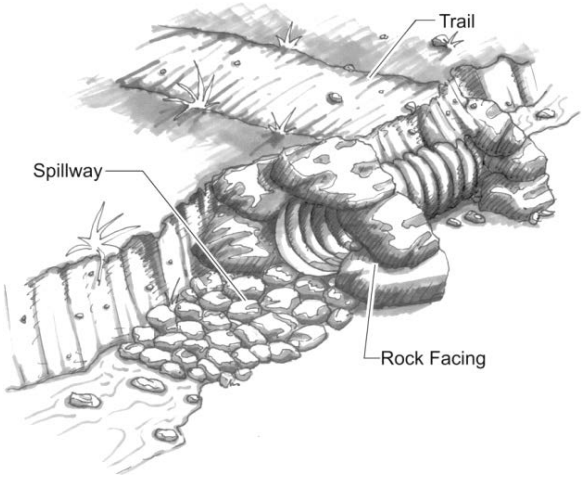


Figure A.28 - Armored Culverts

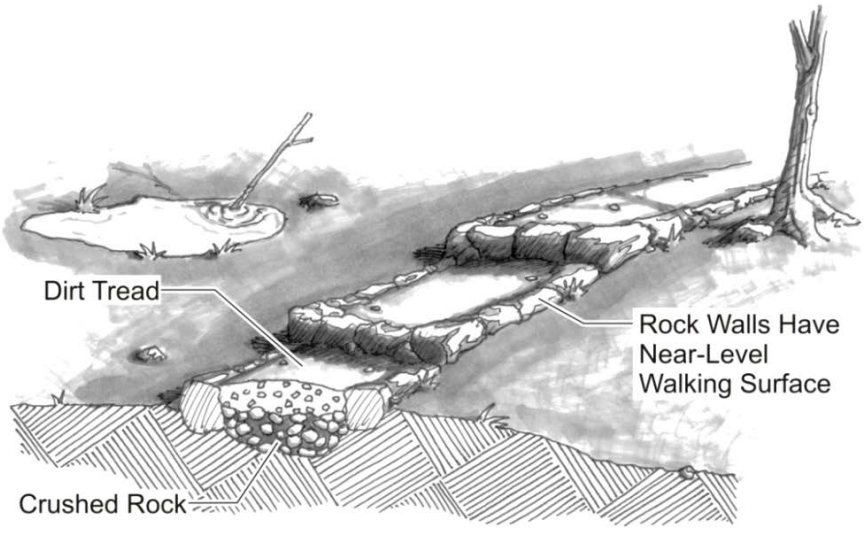


Figure A.29 - Stepped Causeway

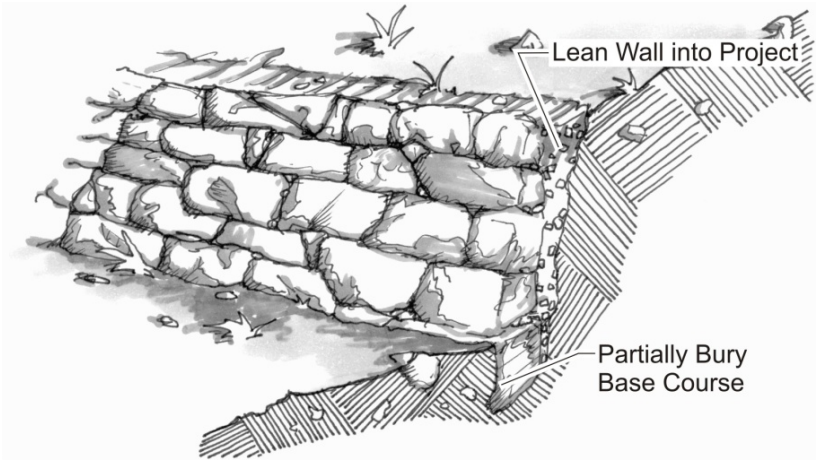


Figure A.30 - Dry Laid Rock Wall

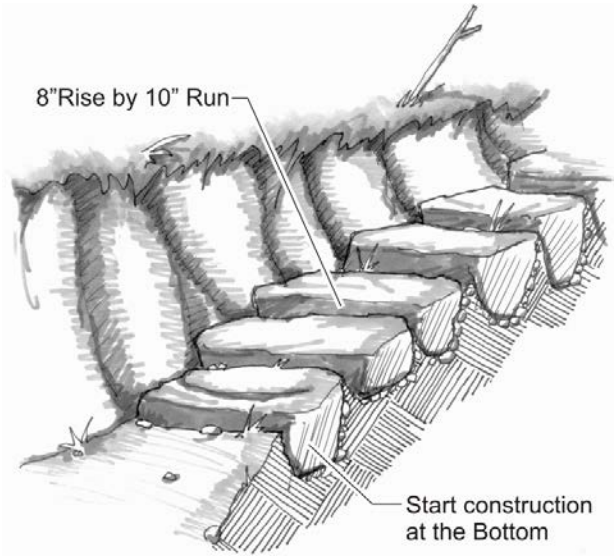


Figure A.31 - Stone Steps

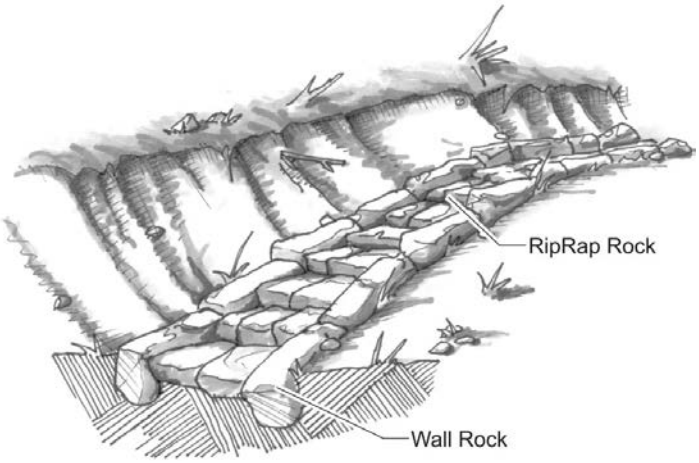


Figure A.32 - Riprap

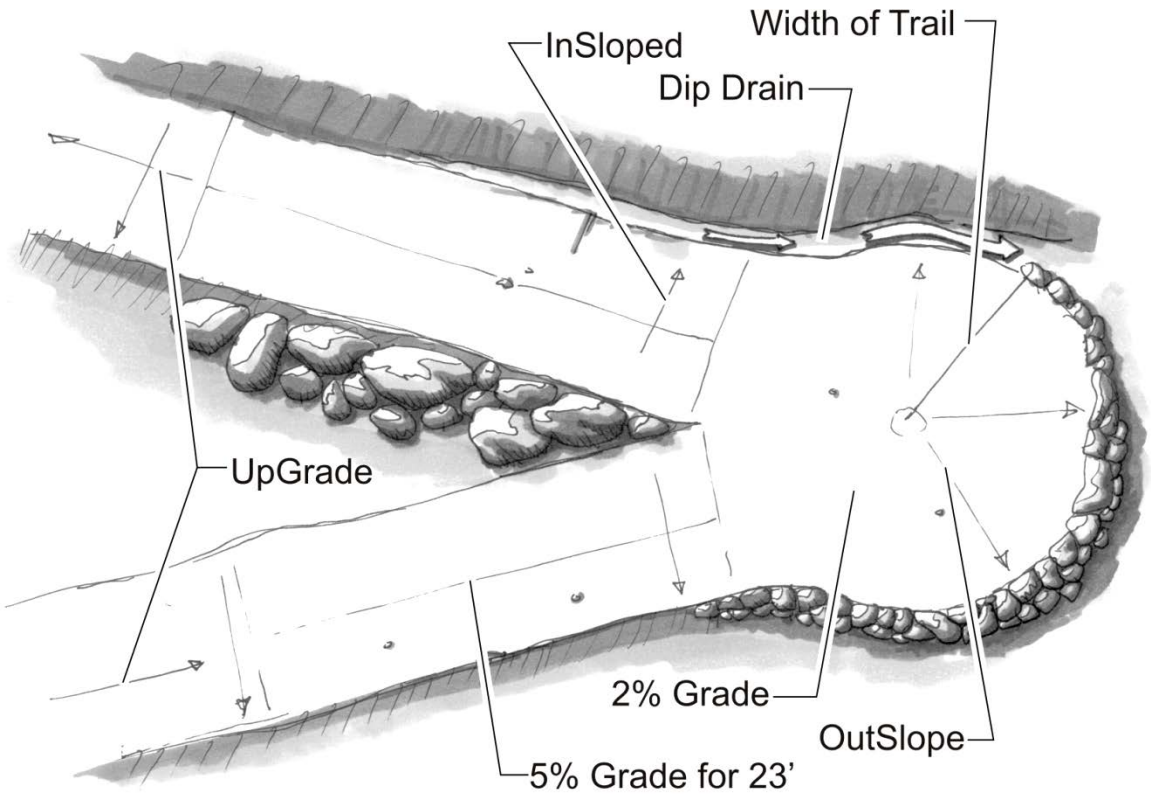


Figure A.33 - Switchback Layout and Design

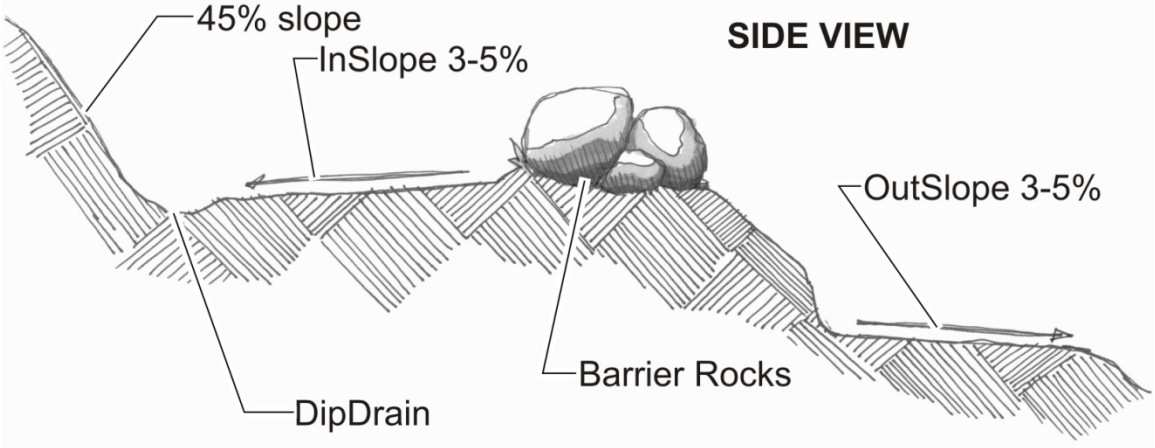


Figure A.34 – Switchback Horizontal View

Appendix B: GPS Trails Data Dictionary

This is the comprehensive GPS trails data dictionary used for Alaska State Parks Trail Inventory and Assessment Project. It was developed in conjunction with the National Park Service (NPS) Rivers and Trails Conservation Assistance (RTCA) program, Alaska Department of Natural Resources (ADNR) Land Record Information Service (LRIS), Department of Parks and Outdoor Recreation (DPOR). For the .ddf file compatible with Trimble TerraSync software, contact the Alaska State Trails Program (ASTP).

Alaska Comprehensive Trail Inventory and Assessment Fields

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
Trailway (Line)					
	PRK_NAME (Park Name)		(Hand Enter)		
	TRL_NAME (Trail Name)		(Hand Enter)		
	TRL_NUM (Trail Name)		(Hand Enter)		
	TRED_WIDTH	The width of the constructed trail tread available for use.	<1 Feet	TW-001	
	(Tread Width)		1-2 Feet	TW-002	
			2-3 Feet	TW-003	
			3-4 Feet	TW-004	
			4-5 Feet	TW-005	
			5-6 Feet	TW-006	
			6-8 Feet	TW-007	
			8-10 Feet	TW-008	
			>10 Feet	TW-009	
	USE_WIDTH	The width of the tread and/or ground surface which shows sign of use or impact by users.	<1 Feet	UW-001	
			1-2 Feet	UW-002	
			2-3 Feet	UW-003	
			3-4 Feet	UW-004	
			4-5 Feet	UW-005	

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			5-6 Feet	UW-006	
			6-8 Feet	UW-007	
			8-10 Feet	UW-008	
			10-20 Feet	UW-009	
			20-50 Feet	UW-010	
			50-100 Feet	UW-011	
			100-200 Feet	UW-012	
			200-400 Feet	UW-013	
			> 400 Feet	UW-014	
	CLRD_WIDTH	The cleared brushing width from the edge of the tread use.	<1 Feet	CW-001	
	(Cleared Width)		1-2 Feet	CW-002	
			2-3 Feet	CW-003	
			3-4 Feet	CW-004	
			4-5 Feet	CW-005	
			5-6 Feet	CW-006	
			6-8 Feet	CW-007	
			>8 Feet	CW-008	
	CLRD_HEIGHT	The cleared brushing height from the surface of tread.	Not Indicated	CH-NIN	
	(Cleared Height)		<6 Feet	CH-001	
			6-8 Feet	CH-002	
			8-10 Feet	CH-003	
			10-12 Feet	CH-004	
			>12 Feet	CH-005	

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
	TRL_GRADE	Percent Grade of tread on a contour-aligned bench; positive or negative.	0-4%	TG-001	
	(Trail Grade)		5-10%	TG-002	
			11-15%	TG-003	
			16-20%	TG-004	
			21-25%	TG-005	
			26-30%	TG-006	
			31-35%	TG-007	
			36-40%	TG-008	
			>40%	TG-009	
		Percent Grade of tread on a fall-line trail; positive or negative.	0-4% FL	TG-010	
			5-10% FL	TG-011	
			11-15% FL	TG-012	
			16-20% FL	TG-013	
			21-25% FL	TG-014	
			26-30% FL	TG-015	
			31-35% FL	TG-016	
			36-40% FL	TG-017	
			>40% FL	TG-018	
	SIDE_SLOPE	Slope of terrain trail crosses.	0-5%	SS-001	
			5-20%*	SS-002	
			20-40%	SS-003	
			40-60%	SS-004	
			60-80%	SS-005	
			80-100%	SS-006	
			>100%	SS-007	

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
	TREDGMTRY	The shape of the trail tread surface (generally within use width).	Flat 0-3%	TE-FLT	Tread is generally flat with less than 3% cross-slope, and no specific geometry.
	(Tread Geometry)		Crowned	TE-CRN	Tread exhibits a convex shaped geometry in which the center of the trail is higher than the sides.
			In-Sloped	TE-ISL	Tread slopes towards the backslope.
			Out-Sloped 4-7%	TE-OSM	Tread slopes away from the backslope 4-7%.
			Out-Sloped >8%	TE-OSF	Tread slopes away from the bakcslope >8%.
			Concave <4"	TE-CON	Tread exhibits a concave geometry in which the center of the tread is <4" lower than the outer edges of the tread.
			Entrenched 4"-12"	TE-EN1	Tread exhibits a trench like geometry in which the center of the tread is 4" - 12" lower than the outer edges of the tread.
			Entrenched >12"	TE-EN2	Tread exhibits a trench like geometry in which the center of the tread is >12" lower than the outer edges of the tread.
			Irregular	TE-IRR	Tread exhibits an irregular geometry than does not fall into other classes.
	SUBSURFACE	Material underlying the trail tread.	Wetland	SR-WLD	Trail subsurface material is saturated with water, and trail alignment travels into an area of wetland, marsh, or bog.
	(Tread Subsurface)		Peat	SR-PET	Trail subsurface material consists plant material in various stages of decay. Material is generally partially to fully saturated with water.
			Mixed Organics	SR-MOR	Trail subsurface material consists of a mixture of peat, silt, sand, clay, and/or gravel.
			Clay	SR-SLT	Trail subsurface material of very fine minerals that show plasticity with various amounts of moisture.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Silt	SR-SND	Trail subsurface material of fine minerals generally grey in color. They are usually found along or near glacial streams or outwash plains, or in areas adjacent to where wind transport has occurred.
			Sand	SR-CLY	Trail subsurface material of moderately fine minerals that lacks plasticity when moist, and contains a "gritty" texture.
			Loam	SR-PUM	Trail subsurface material with a combination of silt, sand, and clay. Material retains plasticity when wet and exhibits a "gritty" texture.
			Pumice	SR-LOM	Trail subsurface material consists of porous volcanic rock.
			Alluvium	SR-ALM	Trail subsurface material consisting of a variety of materials such as clay, silt, sand, gravel, and/or cobbles. Alluvium material is generally deposited by streams or along hillsides from mass wasting. Unlike Glacial Till, Alluvium tends to exhibit sorting.
			Glacial Till	SR-GTL	Trail subsurface material consisting of a variety of materials such as clay, silt, sand, gravel, and/or cobbles. Glacial till has been deposited directly by glaciers and is therefore generally unsorted material.
			Common w/ Gravel	SR-CGV	Trail subsurface material consisting of a mixture of gravel and other (generally organic) materials.
			Common w/ Large Rock	SR-CRK	Trail subsurface material consisting of a mixture of large rocks and other (generally organic) materials.
			Talus or Boulders	SR-TAL	Trail subsurface material consisting of boulders and/ or talus. Generally found at the base of rocky mountainous areas.
			Bedrock	SR-BDR	Trail subsurface material consists of exposed bedrock, and no other soil types are evident.
			Water Xing	SR-WCR	Trail subsurface is flowing water as in a bridge crossing or ford.
			Other	SR-OTH	Trail Subsurface not otherwise described.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
	TRL_SURFACE	Material the trail surface is constructed of.	Native	TS-NTV	No material has been imported, and the trail surface material is identical to the trail subsurface material.
	(Trail Surface)		Running Plank	TS-RPL	Trail surface material generally consisting of 2"X20" or similar treated lumber running along the tread of the trail with little or no underlying support material.
			Boardwalk/Puncheon	TS-BWP	Trail surface structure built with log or dimensional lumber on top of the native soil consisting of sills, stringers, decking, and sometimes gravel on top of the decking.
			Pavers	TS-PVS	Trail surface material consists of 1 foot square by 2 to 4 inch thick concrete blocks.
			Bridge	TS-BRS	Trail surface structure used to cross water bodies.
			Corduroy	TS-CDR	Trail surface structure generally built with native log material or dimensional lumber on top of the native soil consisting of sills, stringers, and decking. A primitive Puncheon.
			Geotex	TS-GTX	Trail surface consisting of any form of geosynthetics including Geo-Bloc. Material can be exposed or covered by native or imported material.
			Turnpike	TS-TPK	Trail surface can be a combination of materials used to make the trail tread higher than the surrounding water table with adjacent ditches used to lower the water table.
			Causeway	TS-CWY	Trail surface can be a combination of materials used to make the trail tread higher than the surrounding water table.
			Brush/Rough Filled	TS-BRF	Trail surface consisting of an unassembled array of local brush material set upon the degraded trail tread in an attempt to improve its surface.
			Asphalt	TS-ASP	Trail surface consisting of paved asphalt.
			Chunkwood	TS-CHW	Trail surface consisting of woodchips of varying sizes.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Rip-Rap	TS-RRP	Trail surface consisting of large rocks placed randomly on the trail surface to provide support and prevent erosion.
			Imported Compact	TS-IMC	Trail surface consisting of imported material, generally gravel size, that has been compacted by trail construction or use.
			Imported Loose	TS-IML	Trail surface consisting of imported material, generally gravel size, that has been loosely placed on the tread.
			Concrete	TS-CCT	Trail surface consisting of concrete slabbing.
			Snow	TS-SNW	Trail surface is covered in snow.
			Water	TS-H2O	Trail surface is covered in water.
			Other	TS-OTH	Other trail surface.
	TRL_TYPE	Type of trail within system.	Main	TT-MAN	Main artery type trail of a trail system.
	(Trail Type)		Secondary	TT-SEC	Secondary-type trail of a trail system; generally connected to a main trail.
			Social	TT-SOC	Social trail established by users, and not part of the maintained or managed trail system.
			ABND-Degraded	TT-ADE	Abandoned trail which has been severely degraded.
			ABND-Stable	TT-AST	Abandoned trail whose condition is stable.
			ABND-Reclaim	TT-ARE	Abandoned trail that has been reclaimed by vegetation and the surrounding environment.
			Access	TT-ACS	Trail used to access the main trail network or some other point of interest from a town, road, trailhead, or other trail system.
			Cutoff	TT-CUT	Trail used to shorten the travel distance along the main trail, such as a switchback cut.
			Spur	TT-SPR	Trail leaving the main trail and traveling to some unestablished location or point of interest.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Other	TT-OTH	Other trail type
	TRACK	The type of track exhibited by use.	Single Track	TK-STR	Trail use exhibits a single track; generally less than 4' wide.
	(Track Type)		Double Wheel	TK-DWH	Trail use exhibits a double track with each individual track; generally less than 4' wide.
			Wide	TK-WID	Trail use exhibits a single track; generally greater than 4' wide.
			Multi-Braid 2-4	TK-MB2	Trail use exhibits 2-4 braided tracks.
			Multi-Braid 5-10	TK-MB5	Trail use exhibits 5-10 braided tracks.
			Multi-Braid >10	TK-10P	Trail use exhibits >10 braided tracks.
			Not Indicated	TK-NIN	No track evident, or not applicable for the surface type.
			Other	TK-OTH	Other type of track not otherwise indicated.
	DITCH	Ditch used for water drainage; usually along the trail alignment between the backslope and tread surface.	None	DT-NON	There are no ditches along the trailway.
			Single Side	DT-SSI	There is a ditch on a single side of the trailway.
			Both Sides	DT-BSI	There is a ditch on both sides of the trailway.
	DRAINAGE	Drainage characteristic of the trail tread.	Well drained	DR-WDR	The trail surface is dry and appears well drained.
	(Soil Drainage)		Moderately Drained	DR-MDR	The trail surface exhibits some moisture, and is moderately drained.
			Poorly Drained	DR-PDR	The trail surface is quite wet, and exhibits poor drainage-characteristics, including the formation of mud and/or other type of degradation.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Saturated	DR-SAT	The trail surface and subsurface is completely saturated and very wet, and may exhibit several forms of degradation including deep mud.
			Ponded	DR-PND	The trail surface and subsurface is completely submerged in ponded water.
			Water Running	DR-WR	There is water running along the trail surface that may have the potential to cause channeling and/or other forms of degradation.
			Not Indicated	DR-NIN	Drainage characteristics are not indicated (as in over a bridge surface).
	DEGRADE	Types of degradation occurring along the tread.	None	DG-NON	Trail is generally in good condition, and no obvious degradation signs are evident.
	(Trail Degradation)		Muddy	DG-MUD	Trail has a muddy surface.
			Extremely Muddy	DG-EMD	Trail is extremely muddy inhibiting travel; mud may be several inches to over a foot in depth.
			Multi Muck Holes	DG-MMH	Trail is extremely muddy, and there are several areas of standing water within the tread of the trail.
			Seasonal Impassable	DG-SIM	Trail may be impassable during certain times of the year, such as spring run-off.
			Elevated Roots	DG-ERT	Trail tread is infused with many elevated roots.
			Loose Rocks	DG-LRK	Trail tread is covered with many loose rocks.
			Elevated Rocks	DG-ERK	Trail tread is infused with many large elevated rocks.
			Channeling	DG-CHL	Trail exhibits channeling along or across the trail trail tread due to water erosion.
			Backslope - Unstable	DG-BSU	Trail backslope is unstable and material is sloughing onto the trail surface.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Backslope - Failure	DG-BSF	Trail backslope has failed, and as a result the tread surface has been damaged or completely covered in slough.
			Bench - Unstable	DG-BUN	Trail bench is exhibiting signs of instability such as sloughing or creep.
			Bench - Failure	DG-BFL	Trail bench has failed, and the tread surface which lies on the bench is no longer usable.
			Other	DG-OTH	Other type of degredation.
	RUTTING	Rutting and/or subsidence occurring along the trail (generally an OHV attribute).	NONE	RS-NON	There is no rutting along the trailway.
	(Rutting/Subsidence)		<2 inch	RS-001	Ruts are <2" in depth.
			2-8 Inch	RS-002	Ruts are 2"-8" in depth.
			9-16 Inch	RS-003	Ruts are 9"-16" in depth.
			17-32 Inch	RS-004	Ruts are 17"-32" in depth.
			33-60 Inch	RS-005	Ruts are 33"-60" in depth.
			>60 Inch	RS-006	Ruts are >60" in depth.
	BENCH	The fraction of the tread lying within the constructed bench.	None	BN-NON	The trail tread does not sit on a bench.
			1/4-3/4 Bench	BN-HBN	The trail tread sits on a 1/4 - 3/4 bench.
			Full Bench	BN-FBN	The trail tread sits on a full bench.
	BERMSLUF	Indicates the presence of berms or sloughing along the trail tread.	Berm	BS-BRM	The edge of the trail exhibits a berm which may cause the trail outslope to be ineffective.
	(Berm or Slough)		Slough	BS-SLO	The edge of the trail exhibits sluffing which may be a result of an unstable backslope or sideslope, and lead to creep along the edge of the trail.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Berm/Slough	BS-BSL	The trail edge exhibits both a berm and sluffing.
			None	BS-NON	There is no berm or sluffing along the tread.
	COMMENTS		(Hand Enter)		
Drain_St (Point) (Drainage Structure)					
	FEATURE	Drainage Structure Type	Drain Dip	DS-DND	A gentle dip designed to divert water off of a trail.
			Waterbar	DS-WBR	A structure used to divert water off of a trail by using a barrier and outsloping.
			Culvert	DS-CVT	A pipe-like structure used to direct water beneath a trail (from one side to the other).
			Dam	DS-DAM	A barrier constructed across a waterway to control the flow or raise the level of water; trail can cross on top of the dam's embankment.
			Spillway	DS-SPY	A channel or passage where excess water exits a dam.
			Check Dam	DS-CKD	A dam designed to collect fine fill material from, and slow the velocity of flowing water; used to reconstruct eroded trails.
			Cross Ditch	DS-CDS	A ditch across the trail tread; can be man-made, or formed by the erosive forces of flowing water.
			Underdrain	DS-CDE	A drain that transports water underneath the trail tread, and deposits it away from a trail.
			Knick	DS-UND	A section of trail with exaggerated outslope; used to drain water from a trail's surface.
			Drain/Sump	DS-KNC	Where a drain removes water from a low point on a trail.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Cross Drain	DS-CRD	Structure built across the tread which drains water downhill; similar to a cross ditch but reinforced with imported material.
			Open Top Culvert	DS-OTC	Open-topped version of a culvert.
			Sheet Drain Start	DS-SDS	Drain designed to collect seepage and overland flow before it can drain onto a trail; start.
			Sheet Drain End	DS-SDE	Drain designed to collect seepage and overland flow before it can drain onto a trail; end.
			Other	DS-OTH	Other drainage structure not otherwise described.
	CONDITION	Condition of the Drainage Structure	Routine Maintenance	CN-RMN	Feature only requires routine maintenance.
			Repair/Rehab Major	CN-RMJ	Feature will require major repair and/or rehabilitation to function properly.
			Repair/Rehab Minor	CN-RMN	Feature will require minor repair and/or rehabilitation to function properly.
			Decommission	CN-DCM	Feature should be decommissioned.
			Expansion	CN-EXP	Feature is ineffective in its current state, and should be expanded upon to meet public need.
			Alter Function	CN-ALT	Feature is functioning in a matter different than what it was designed for.
			Install New	CN-NEW	Feature is not functioning as intended and a new structure should be installed.
	MATERIAL	Material of the Drainage Structure	Rock	MT-ROC	Imported or natural large rock.
			Treated Log	MT-TLG	Imported or local full round logs with weather proofing.
			Untreated Log	MT-NLG	Imported or local full round logs.
			Treated Dimensional Timber	MT-TDW	Imported or local dimensional lumber with weather proofing.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Untreated Dimensional Timber	MT-NDW	Imported or local dimensional lumber.
			Metal	MT-MET	Metal material
			Metal/Wood	MT-MWD	Combined metal and wood material.
			Concrete	MT-CON	Concrete material
			Composites	MT-CMT	Composite materials such as plywood, carbon fiber, fiberglass, etc.
			Plastic or Rubber	MT-PLS	Plastic and/or rubber material.
			Native Soil	MT-NSL	Surrounding native soil material.
			Select Borrow	MT-SBR	Selected material taken from a specific site along the trail.
			Aggregate	MT-AGG	A mixture of sand, gravel, concrete, and/or crushed stone.
			Asphalt	MT-ASP	Aggregate material bound by viscous petroleum (as in paved roads).
			Mixed Material	MT-MMT	A mixture of any of the other materials indicated.
			Other	MT-OTH	Material not otherwise indicated.
	WIDTH_FT	The width of the drainage structure in feet.	(Hand Enter)		
	LENGTH_FT	The length of the drainage feature in feet.	(Hand Enter)		
	COMMENTS		(Hand Enter)		
AquaProb (Point) (Water Problem)					

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
	FEATURE	The type of drainage and/or water related problem on the trail.	Wash Out	AP-WOT	Where running water has eroded the entire tread of a section of a trail.
			Head Cut	AP-HCT	Site where erosion is traveling upstream as the stream cuts downward (similar to a stream cut-bank).
			Erosion Zone Start	AP-EZa	Erosion problem; start.
			Erosion Zone End	AP-EZb	Erosion problem; end.
			Dam or Blockage	AP-DAM	Where a dammed area has degraded the trail behind it by lack of drainage.
			Ponded Area	AP-PND	Area of standing water on a trail.
			Muckhole	AP-MCH	Trail is extremely muddy, AND there is standing water within the tread of the trail.
			Channel Start	AP-ECa	Water traveling on a trail's surface and creating an erosion channel; start.
			Channel End	AP-ECb	Water traveling on a trail's surface and creating an erosion channel; end.
			Deposition Zone	AP-DZN	Area where debris has collected on trail surface.
			Seepage Zone	AP-SZN	Where water is flowing out of the ground onto the ground and/or tread surface.
			Other	AP-OTH	Other water problem not otherwise described.
	COMMENTS		(Hand Enter)		
Water_Xing (Point) (Water Crossing)					
	CROSS_TYPE	The type of structure used for the water crossing.	Bridge	WX-BRI	Structure taller than 4 feet that crosses water.
			Natural Ford	WX-NFD	Unimproved natural stream or river crossing.
			Constructed Ford	WX-CFD	Improved stream or river crossing.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Covered Culvert	WX-CCV	Culvert larger than 24" that a trail crosses over.
			Stepping Stones	WX-SST	Stones placed in waterway to provide dry steps across.
			Hand Tram	WX-HTR	River crossing by hand-cranking a tram; cables are tethered to each side of the riverbank.
			Other	WX-OTH	Other water crossing structure not otherwise described.
	CONDITION	The condition of the water crossing.	Routine Maintenance	CN-RMN	Feature only requires routine maintenance.
			Repair/Rehab Major	CN-RMJ	Feature will require major repair and/or rehabilitation to function properly.
			Repair/Rehab Minor	CN-RMN	Feature will require minor repair and/or rehabilitation to function properly.
			Decommission	CN-DCM	Feature should be decommissioned.
			Expansion	CN-EXP	Feature is ineffective in its current state, and should be expanded upon to meet public need.
			Alter Function	CN-ALT	Feature is functioning in a matter different than what it was designed for.
			Install New	CN-NEW	Feature is not functioning as intended and a new structure should be installed.
	MATERIAL	Material of the Water Crossing Structure.	Rock	MT-ROC	Imported or natural large rock.
			Treated Log	MT-NLG	Imported or local full round logs with weather proofing.
			Untreated Log	MT-TLG	Imported or local full round logs.
			Treated Dimensional Timber	MT-NWD	Imported or local dimensional lumber with weather proofing.
			Untreated Dimensional Timber	MT-CDT	Imported or local dimensional lumber.
			Metal	MT-MET	Metal material

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Metal/Wood	MT-MWD	Combined metal and wood material.
			Concrete	MT-CON	Concrete material
			Composites	MT-CMT	Composite materials such as plywood, carbon fiber, fiberglass, etc.
			Plastic or Rubber	MT-PLS	Plastic and/or rubber material.
			Native Soil	MT-NSL	Surrounding native soil material.
			Select Borrow	MT-SBR	Selected material taken from a specific site along the trail.
			Aggregate	MT-AGG	A mixture of sand, gravel, concrete, and or crushed stone.
			Asphalt	MT-ASP	Aggregate material bound by viscous petroleum (as in paved roads).
			Mixed Material	MT-MMT	A mixture of any of the other materials indicated.
			Clay	MT-SLT	Surface material of very fine minerals that show plasticity with various amounts of moisture.
			Other	MT-OTH	Material not otherwise indicated.
	WIDTH_FT (Width in Feet)	Structure width in feet.	(Hand Enter)		
	LENGTH_FT (Length in Feet)	Structure length (stringer span) in feet.	(Hand Enter)		
	STM_WDT_FT (Stream Width in Feet)	Bank to bank of stream width in feet.	(Hand Enter)		
	WEIGHT_LIM_TON (Weight limit in tons)	Enter only if the value is known.	(Hand Enter)		
	STREAM_NAME	Name of stream (if named).	(Hand Enter)		
	COMMENTS		(Hand Enter)		

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
Structures (Point)					
	FEATURE	Trailside structure type.	Traffic Counter	ST-CNT	Device used to record traffic volumes of wheeled vehicles.
			Registration box	ST-RBX	Box-like structure used for trail users to self register.
			Docks	ST-DOK	Floating or fixed structure along the edge of a waterbody.
			Bench	ST-BNH	Structure along a trail designed for sitting and resting.
			Information Board	ST-INF	Structure used to display park-related information. Unlike a Kiosk, information on this board can easily be updated (i.e. bear warnings).
			Trash - Non-Bear	ST-TNB	Non-bearproof refuse container.
			Trash - Bearproof	ST-TBP	Bearproof refuse container.
			Bear Box	ST-BBX	Stationary bear-resistant storage containers.
			Campsite Dev	ST-CMD	Developed campsite.
			Campsite Prim	ST-CMP	Campsite; primitive or user established.
			Fire Ring	ST-FRG	Circular structure used to contain a campfire.
			Fee Station	ST-FEE	Fee station for parking or camping.
			Overlook/Pull Out	ST-OVL	Scenic overlook; trailside or roadside.
			Pay Phone	ST-PPH	Pay Phone.
			Picnic Table	ST-PTB	Table with integrated benches used for picnicking.
			Sculpture/Artwork	ST-ART	Any structure used as a display of artwork.
			Telescope	ST-TEL	Telescope permanently fixed at a site along the trail.
			Water Source	ST-H2O	Structure used for the extraction of freshwater, as in a hand pump operated well.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Other	ST-OTH	Other trailside structure not otherwise described.
	CONDITION	Condition of the trailside structure.	Routine Maintenance	CN-RMN	Feature only requires routine maintenance.
			Repair/Rehab Major	CN-RMJ	Feature will require major repair and/or rehabilitation to function properly.
			Repair/Rehab Minor	CN-RMN	Feature will require minor repair and/or rehabilitation to function properly.
			Decommission	CN-DCM	Feature should be decommissioned.
			Expansion	CN-EXP	Feature is ineffective in its current state, and should be expanded upon to meet public need.
			Alter Function	CN-ALT	Feature is functioning in a matter different than what it was designed for.
			Install New	CN-NEW	Feature is not functioning as intended and a new structure should be installed.
	MATERIAL	Material of the Trailside Structure	Rock	MT-ROC	Imported or natural large rock.
			Treated Log	MT-NLG	Imported or local full round logs with weather proofing.
			Untreated Log	MT-TLG	Imported or local full round logs.
			Treated Dimensional Timber	MT-NWD	Imported or local dimensional lumber with weather proofing.
			Untreated Dimensional Timber	MT-CDT	Imported or local dimensional lumber.
			Metal	MT-MET	Metal material
			Metal/Wood	MT-MWD	Combined metal and wood material.
			Concrete	MT-CON	Concrete material
			Composites	MT-CMT	Composite materials such as plywood, carbon fiber, fiberglass, etc.
			Plastic or Rubber	MT-PLS	Plastic and/or rubber material.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Native Soil	MT-NSL	Surrounding native soil material.
			Select Borrow	MT-SBR	Selected material taken from a specific site along the trail.
			Aggregate	MT-AGG	A mixture of sand, gravel, concrete, and or crushed stone.
			Asphalt	MT-ASP	Aggregate material bound by viscous petroleum (as in paved roads).
			Mixed Material	MT-MMT	A mixture of any of the other materials indicated.
			Other	MT-OTH	Material not otherwise indicated.
	COMMENTS		(Hand Enter)		
Trl_Structure (Point)					
	FEATURE	Type of trail structure feature.	Retaining Wall	TR-RET	Structure used to prevent the trail tread from slumping, and to provide stability and strength to the edge of the trail.
			Corduroy	TS-CDR	Trail surface structure generally built with native log material or dimensional lumber on top of the native soil consisting of sills, stringers, and decking. A primitive Puncheon.
			Boardwalk/Puncheon	TR-BWP	Trail surface structure built with log or dimensional lumber on top of the native soil consisting of sills, stringers, decking, and sometimes gravel on top of the decking.
			Running Plank	TR-RPL	Trail surface material generally consisting of 2"X20" or similar treated lumber running along the tread of the trail with little or no underlying support material.
			Geotex	TS-GTX	Trail surface consisting of any form of geosynthetics including Geo-Bloc. Material can be exposed or covered by native or imported material.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Pavers	TS-PVS	Trail surface material consists of 1 foot square by 2 to 4 inch thick concrete blocks.
			Turnpike	TS-TPK	Trail surface can be a combination of materials used to make the trail tread higher than the surrounding water table with adjacent ditches used to lower the water table.
			Causeway	TS-CWY	Trail surface can be a combination of materials used to make the trail tread higher than the surrounding water table.
			Stairway	TR-SWY	Stairway structure used to ascends/descend a steep grade.
			Handrail	TR-HND	Handrail structure for stability while travelling along trail.
			Slope Armoring	TR-SAR	Structure used to "Armor" or reinforce the side-slope to help prevent erosion.
			Tunnel	TR-TUN	Trail travels through a tunnel.
			Other	TR-OTH	Other trail related structure not otherwise indicated.
	MATERIAL	Material of the Trail Structure.	Rock	MT-ROC	Imported or natural large rock.
			Treated Log	MT-NLG	Imported or local full round logs with weather proofing.
			Untreated Log	MT-TLG	Imported or local full round logs.
			Treated Dimensional Timber	MT-NWD	Imported or local dimensional lumber with weather proofing.
			Untreated Dimensional Timber	MT-CDT	Imported or local dimensional lumber.
			Metal	MT-MET	Metal material
			Metal/Wood	MT-MWD	Combined metal and wood material.
			Concrete	MT-CON	Concrete material
			Composites	MT-CMT	Composite materials such as plywood, carbon fiber, fiberglass, etc.
			Plastic or Rubber	MT-PLS	Plastic and/or rubber material.
			Native Soil	MT-NSL	Surrounding native soil material.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Select Borrow	MT-SBR	Selected material taken from a specific site along the trail.
			Aggregate	MT-AGG	A mixture of sand, gravel, concrete, and or crushed stone.
			Asphalt	MT-ASP	Aggregate material bound by viscous petroleum (as in paved roads).
			Mixed Material	MT-MMT	A mixture of any of the other materials indicated.
			Other	MT-OTH	Material not otherwise indicated.
	CONDITION	The condition of the trail structure.	Routine Maintenance	CN-RMN	Feature only requires routine maintenance.
			Repair/Rehab Major	CN-RMJ	Feature will require major repair and/or rehabilitation to function properly.
			Repair/Rehab Minor	CN-RMN	Feature will require minor repair and/or rehabilitation to function properly.
			Decommission	CN-DCM	Feature should be decommissioned.
			Expansion	CN-EXP	Feature is ineffective in its current state, and should be expanded upon to meet public need.
			Alter Function	CN-ALT	Feature is functioning in a matter different than what it was designed for.
			Install New	CN-NEW	Feature is not functioning as intended and a new structure should be installed.
	LENGTH_FT (Length in Feet)		(Hand Enter)		
	HEIGHT_FT (Height in Feet)		(Hand Enter)		
	WIDTH_IN (Width in Inches)		(Hand Enter)		

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
	COMMENTS		(Hand Enter)		
Restrict (Point) (Access Restriction)					
	FEATURE	Access Restriction Feature Type.	Barricade	RD-BCD	A portable or fixed barrier having object markings; used to close all or a portion of the trail right-of-way to traffic.
			Bollard	RD-BOL	A barrier post, usually 30 to 42 inches in height, used to block vehicular traffic at trail access points. Should be installed in odd numbers (one or three). Also an electric light post found alongside trails.
			Stile	RD-STL	A ramp, step, or set of steps for hikers to pass over a fence or wall.
			Fence	RD-FNC	A constructed barrier of wood, masonry, stone, wire, or metal, erected to screen or separate areas.
			Gate	RD-GAT	Structure that can be swung, drawn, or lowered to block an entrance or passageway.
			Other	RD-CUS	Other access restriction feature.
	MATERIAL	Material of the Trail Structure.	Rock	MT-ROC	Imported or natural large rock.
			Treated Log	MT-NLG	Imported or local full round logs with weather proofing.
			Untreated Log	MT-TLG	Imported or local full round logs.
			Treated Dimensional Timber	MT-NWD	Imported or local dimensional lumber with weather proofing.
			Untreated Dimensional Timber	MT-CDT	Imported or local dimensional lumber.
			Metal	MT-MET	Metal material
			Metal/Wood	MT-MWD	Combined metal and wood material.
			Concrete	MT-CON	Concrete material

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Composites	MT-CMT	Composite materials such as plywood, carbon fiber, fiberglass, etc.
			Plastic or Rubber	MT-PLS	Plastic and/or rubber material.
			Native Soil	MT-NSL	Surrounding native soil material.
			Mixed Material	MT-MMT	A mixture of any of the other materials indicated.
			Other	MT-OTH	Material not otherwise indicated.
	CONDITION	Condition of restriction feature.	Routine Maintenance	CN-RMN	Feature only requires routine maintenance.
			Repair/Rehab Major	CN-RMJ	Feature will require major repair and/or rehabilitation to function properly.
			Repair/Rehab Minor	CN-RMN	Feature will require minor repair and/or rehabilitation to function properly.
			Decommission	CN-DCM	Feature should be decommissioned from use.
			Expansion	CN-EXP	Feature is ineffective in its current state, and should be expanded upon to meet public need.
			Alter Function	CN-ALT	Feature is functioning in a matter different than what it was designed for.
			Install New	CN-NEW	Feature is not functioning as intended and a new structure should be installed.
	WIDTH_IN (Width in Inches)		(Hand Enter)		
	HEIGHT_FT (Height in Feet)		(Hand Enter)		
	LENGTH_FT (Length in Feet)		(Hand Enter)		

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
	COMMENTS		(Hand Enter)		
Build_Edge (Line) (Building Edge)					
	FEATURE	Type of building.	Restroom	BD-RRM	Bathroom facility with plumbing.
			Outhouse	BD-OUT	Bathroom facility without plumbing.
			Picnic Shelter	BD-PSH	Picnic structure with roof, picnic tables, garbage cans, and occasionally grills.
			Tent Platform	BD-TPL	Flat decking elevated above the ground for tent placement.
			Cabin-Public	BD-CPB	Cabin available for public use.
			Cabin-Private	BD-CPR	Cabin owned by a private party and not available for public use.
			Ranger Station	BD-RST	Structure which houses ranger related activities.
			Visitor Center	BD-VSC	Structure which acts as an interpretive and information facility for the public
			Storage	BD-STG	Structure used for storage.
			Other	BD-OTH	Building not otherwise described.
	RIGHT-LEFT	Location of building in reference to.	Right	BD-RGT	
		line collection direction.	Left	BD-LFT	
	WIDTH_FT (Width in Feet)	The dimension of the building along the direction NOT collected.	(Hand Enter)		
	CONDITION	Building Condition	Routine Maintenance	CN-RMN	Feature only requires routine maintenance.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Repair/Rehab Major	CN-RMJ	Feature will require major repair and/or rehabilitation to function properly.
			Repair/Rehab Minor	CN-RMN	Feature will require minor repair and/or rehabilitation to function properly.
			Decommission	CN-DCM	Feature should be decommissioned from use.
			Expansion	CN-EXP	Feature is ineffective in its current state, and should be expanded upon to meet public need.
			Alter Function	CN-ALT	Feature is functioning in a matter different than what it was designed for.
			Install New	CN-NEW	Feature is not functioning as intended and a new structure should be installed.
	COMMENTS		(Hand Enter)		
Refer_Pt (Point) (Reference Point)					
	FEATURE	The type of reference point feature.	Admin Boundary	RP-BRY	A limit or boundary along a trail at which government jurisdiction, or trail use restrictions change.
			Monument	RP-MON	An object placed to mark key survey points on the earth's surface. Objects can be anything from a nail to a large circular brass disk.
			Timber Source	RP-TIM	A point describing an area which has been or has the potential to be used for timber resources.
			Timberline	RP-TLN	A point along the trail at which vegetation changes from forested to non forested or vice-versa. May be in the alpine, or in muskeg.
			Gravel Source	RP-RCK	A point describing an area which has been or has the potential to be used for gravel resources.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Staging Area	RP-STG	A point describing an area which has been or has the potential to be used as a staging area for various activities.
			Mountain Pass	RP-PSS	A point along the trail at which a mountain pass is located.
			Mountain Summit	RP-SMT	A point along the trail at which a mountain summit is located.
			Scenic Overlook	RP-SOK	A point along or near the trail where a developed scenic overlook is located often containing benches, telescopes, and/or interpretive signs.
			Avalanche Chute	RP-CHT	A point along the trail at which there is evidence of avalanches accruing in the winter.
			Heli Landing	RP-HEL	A point describing an area which has been or has the potential to be used as a Helicopter Landing Pad.
			Cultural Resource	RP-CUL	A point along or near the trail describing an area that has evidence of archeological significance.
			Nest Site	RP-NST	A point along or near the trail describing an area that has evidence nesting by mammals and/or birds.
			Other	RP-CUS	Other points of interest not otherwise described.
	COMMENTS		(Hand Enter)		
Hazard (Point)					
	FEATURE	Type of trail hazard.	Abrupt Trail End	HZ-ATE	Trail unexpectedly ends.
			Bog Hole/Depression	HZ-BHD	Depression in the trail often saturated and/or filled with water.
			Brush/branches/Veg	HZ-BGH	Point along the trail in which vegetation has encroached to a hazardous degree.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Extr Cross Slope	HZ-XCS	Point along the trail at which the cross slope is extreme enough to inhibit travel.
			Extr Rough Surface	HZ-XRS	Point along the trail at which the tread surface becomes extremely rough, and inhibits travel.
			Fallen Tree	HZ-FLT	Fallen tree impeding efficient travel on a trail.
			Landslide/Debris Flw	HZ-LDF	Point along the trail at which a landslide or debris flow is inhibiting travel.
			Large Rocks	HZ-LRX	Point along the trail at which very large rocks inhibit travel.
			Major Washout	HZ-MWO	Point along the trail at which a major washout of the trail tread has occurred.
			Slick Surface	HZ-SSF	Point along the trail at which the tread surface becomes extremely slick inhibiting travel.
			Steep Grade	HZ-SGD	Point along the trail at which the trail alignment becomes extremely steep in grade.
			Steep Side Drop Off	HZ-SSD	Point along the trail at which the slope below a tread bench drops off precariously.
			Structure Failure	HZ-SFL	Point along the trail at which a trail related structure has failed.
			Water Hazard	HZ-WHZ	Point along the trail at which a substantial hazard associated with water is occurring.
			Standing Tree	HZ-STR	Point along the trail at which a large tree(s) is standing within the trail tread inhibiting travel.
			Pinch Point	HZ-PPT	Point along the trail at which the trail alignment becomes very narrow or pinched due to the surrounding environment.
			Blind Corner	HZ-BCR	Point along the trail at which sight distance is reduced to a hazardous level.
			Blind Intersection	HZ-BIN	Point along the trail at which a trail intersection is visually difficult to identify.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Wildlife Hazard	HZ-WHZ	Point along the trail where a wildlife hazard exhists.
			Vegetation Hazard	HZ-VHZ	Point along the trail where a vegetation hazard exists.
			Other	HZ-OTH	Point along the trail where another trail hazard, not otherwise described, exists.
	COMMENTS		(Hand Enter)		
Signs (Point)					
	FEATURE	Type of sign.	Cairn	SN-CRN	Pile of rocks used as a route guide.
			Route Marker Post	SN-PST	Post-like (or similar) structure used as a sign along a trail.
			Tree Blaze/Marker	SN-BLZ	A painted, cut, or otherwise evident marking in a tree used as sign along the trail.
			Route Blaze - Reflective	SN-BZR	A reflective material set along the trail and used as a sign.
			Buoy	SN-BOY	A buoy used as a sign along a water trail.
			Mileage Marker	SN-MMK	A marker along a trail indicating mileage.
			Sign	SN-SGN	A generic type of sign used along the trail.
			Custom Route Marker	SN-CUS	A custom-made route marker for a specific purpose.
			Kiosk	SN-KSK	A large sign structure used to display information along a trail, or at a trailhead.
			Other	SN-OTH	Another type of sign not otherwise indicated.
	SIGN_USE	What the sign is used for.	Guide or Destination	SU-GDS	Sign used to guide the user or to describe a destination.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Boundary	SU-BDY	Sign used to depict the boundary of an area.
			Warning	SU-WRN	Sign used to warn a trail user.
			Regulatory	SU-REG	Sign used to exhibit a regulation.
			Informational	SU-INF	Sign used to provide general information.
			Interpretive	SU-INT	Sign used for interpreatation along the trail.
			Mixed	SU-MIX	Sign that has a mix of uses.
			Other	SU-OTH	Other type of sign use not otherwise indicated.
	CONDITION	The condition of the sign.	Routine Maintenance	CN-RMN	Feature only requires routine maintenance.
			Repair/Rehab Major	CN-RMJ	Feature will require major repair and/or rehabilitation to function properly.
			Repair/Rehab Minor	CN-RMN	Feature will require minor repair and/or rehabilitation to function properly.
			Decommission	CN-DCM	Feature should be decommissioned from use.
			Expansion	CN-EXP	Feature is ineffective in its current state, and should be expanded upon to meet public need.
			Alter Function	CN-ALT	Feature is functioning in a matter different than what it was designed for.
			Install New	CN-NEW	Feature is not functioning as intended and a new structure should be installed.
	HEIGHT_FT (Height in Feet)		(Hand Enter)		
	MATERIAL	Material of the Sign and Post.	Rock	MT-ROC	Imported or natural large rock.
			Treated Log	MT-NLG	Imported or local full round logs with weather proofing.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Untreated Log	MT-TLG	Imported or local full round logs.
			Treated Dimensional Timber	MT-NWD	Imported or local dimensional lumber with weather proofing.
			Untreated Dimensional Timber	MT-CDT	Imported or local dimensional lumber.
			Metal	MT-MET	Metal material
			Metal/Wood	MT-MWD	Combined metal and wood material.
			Concrete	MT-CON	Concrete material
			Composites	MT-CMT	Composite materials such as plywood, carbon fiber, fiberglass, etc.
			Plastic or Rubber	MT-PLS	Plastic and/or rubber material.
			Mixed Material	MT-MMT	A mixture of any of the other materials indicated.
			Other	MT-OTH	Material not otherwise indicated.
	COMMENTS		(Hand Enter)		
Anchor_Pt (Point)					
	ANCHOR_TYPE	The type of anchor point.	Beginning	AT-BEG	Beginning observed point for a particualr line feature.
			Midpoint	AT-MID	Middle observed point for a particualr line feature.
			Ending	AT-END	Ending observed point for a particualr line feature.
			Angle	AT-ANG	Angle point for a particular line feature.
			Trailhead	AT-TRH	Trailhead Point for Trailway line feature.
			Trail Junction	AT-TJC	Trail Junction Point for trailway line feature.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Road Junction	AT-RJC	Road Juction point for a road line feature.
			Trail Break	AT-BRK	Break in the trailway line (due to lost sattelites and/or lost trail).
			Powerline Crossing	AT-PXG	Point along a line feature where a powerline crosses.
			Fence Crossing	AT-FXG	Point along a line feature where a fence crosses.
			Other	AT-OTH	Other anchor point not otherwise described to aid in defining a line feature location.
	COMMENTS		(Hand Enter)		
Photo_Pt (Point)					
	FEATURE	What the photo depicts.	Representative Tread	PP-REP	A photograph of the trail tread that is representative of that segment of the trail.
			Structure	PP-TSS	A photograph of a particular trail or trailhead-related structure.
			Bridge/Water Xing	PP-XNG	A photograph of a bridge or other water crossing.
			Hazard	PP-HAZ	A photograph of a trail-related hazard.
			Trailhead	PP-TRH	A photograph of a particular trailhead.
			TH Parking Area	PP-THP	A photograph of a parking area related to a particular Trailhead.
			General Interest	PP-GEN	A photograph of a general interest point.
			Building	PP-BLD	A photograph of a trail or trail-related building.
			Sign	PP-SGN	A photograph of a trail-related sign or signs.
			Condition Photo	PP-CPH	A photograph used to illustrated the condition of a failing structure.

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Viewpoint	PP-VPT	A point along or near the trail at which there is a extraordinary view.
			Other	PP-OTH	A photograph not otherwise described.
	LOOKDIR	Direction the photograph faces.	N	LD-NTH	The photograph is looking North.
	(Look Direction)		NE	LD-NET	The photograph is looking Northeast.
			E	LD-EAS	The photograph is looking East.
			SE	LD-SET	The photograph is looking Southeast.
			S	LD-STH	The photograph is looking South.
			SW	LD-SWT	The photograph is looking Southwest.
			W	LD-WES	The photograph is looking West.
			NW	LD-NWT	The photograph is looking Northwest.
	PHOTOGRAPHER		(Hand Enter initials)		
	COMMENTS		(Hand Enter)		
	INTERNAL	Photo Title (generally trail name).	(Hand Enter)		
Parking (Polygon)					
(Parking Area)					
	SURFACE	Surface of the parking area.	Dirt	PS-DRT	Native or imported dirt surface.
			Gravel	PS-GRV	Gravel surface

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Paved	PS-PAV	Paved surface
			Vegetation	PS-VEG	Vegetated surface
			Other	PS-OTH	Other surface not otherwise indicated.
	SURF_COND	General condition of the Parking area surface.	New	SC-NEW	Condition indicated recent construction and/or grading/resurfacing.
	(Surface Condition)		Functional	SC-FNT	Condition can be described as functional for the level of use and purpose.
			Potholes	SC-PHL	Parking lot surface contains numerous potholes.
			Rutted	SC-RUT	Parking lot surface is rutted.
			Other	SC-OTH	Condition not otherwise indicated.
	GATED		Yes	GT-YES	
			No	GT-NOO	
	FEE_STATION		Yes	FS-YES	
			No	FS-NOO	
	RESTROOM		Yes	RT-YES	
			No	RT-NOO	
	TRASHCAN		Yes	TC-YES	
			No	TC-NOO	

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
	POSTED_HOURS		(Hand Enter)		
	NUM_PARK_SPOT	Number of parking spots.	(Hand Enter)		
	NUM_HANDI_SPOT	Number of handicapped parking spots.	(Hand Enter)		
	COMMENTS		(Hand Enter)		
Roads (Line)					
	NAME	Road Name	(Hand Enter)		
	FEATURE	Type of road.	Access	RD-ACS	Road is used to access a trailhead or other park related facility.
			Primary Hwy	RD-PHY	Road is the primary highway travel corridor.
			Secondary	RD-SDY	Road is a secondary travel corridor.
			Subdivision	RD-SUB	Road is used to access a subdivision.
			Unimproved	RD-UIM	Road has not been improved and/or does not receive maintenance.
			Other	RD-OTH	Other road type not otherwise described.
	ROAD_SURF	Surface material of the road.	Dirt	RR-DRT	Native or imported dirt material which has been mechanically compacted.
	(Road Surface)		Gravel	RR-GRV	Gravel surface

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
			Paved	RR-PVD	Paved surface
			Other	RR-OTH	Other surface not otherwise indicated.
	SURF_COND	Condition of the road surface.	New	SC-NEW	Condition indicated recent construction and/or grading/resurfacing.
	(Surface Condition)		Functional	SC-FNT	Condition can be described as functional for the level of use and purpose.
			Potholes	SC-PHL	Parking lot surface contains numerous potholes.
			Rutted	SC-RUT	Parking lot surface is rutted.
			Other	SC-OTH	Condition not otherwise indicated.
	WIDTH_FT		6-12 Feet	WD-001	
	(Width in Feet)		12+ Feet	WD-002	
	COMMENTS				
Misc_Feature (Point)					
(Miscellaneous Feature)					
	FEATURE	Any feature not listed in other categories that should be described.	(Hand Enter)		
	COMMENTS		(Hand Enter)		
Switchback (Point)					

Feature (Type)	Attribute	Attribute Definition	Values	Code	Description
	TURN_RADIUS	Switchback turn radius in feet.	(Hand Enter)		
	COMMENTS		(Hand Enter)		

Appendix C: Minimum Mapping Requirements

State of Alaska, Department of Natural Resources, Division of Mining, Land and Water has written a set of minimum standards to follow when GPS-mapping trails on their managed land. The Division of Parks and Outdoor Recreation follows these requirements from the following pages when mapping all trails.

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINING, LAND AND WATER

MINIMUM MAPPING REQUIREMENTS
For
TRAIL LOCATION MAPS
On
DNR MANAGED LANDS

These guidelines define the minimum data collection and mapping criteria for preparation of trail location maps on state lands managed by the Department of Natural Resources, Division of Mining, Land and Water. They provide the procedures for field location and graphical representation of the trail and the real property affected. They are applicable only to minor travel routes accessible by foot or non-highway motorized traffic such as snow machines and ATV's. Location of major trails and roads traversable by highway vehicles and accessible to the public highway system will require Special Survey Instructions issued by the Division of Mining, Land and Water.

The "Trail Map" may be used to document the location of trails on State land which are greater than 100 feet from the nearest potential conflicting use or private/non-state property interest. (See example sheet)

These maps may not be used to document existing improvements such as utility lines or supporting facilities. The location of these must be documented with an "As-Built Survey" conducted by an Alaska Registered Land Surveyor.

1. GENERAL FIELD LOCATION STANDARDS

The horizontal mapping datum shall be the North America Datum of 1983 (NAD 83). U.S. Geological Survey "Quad." maps are published in the (NAD 27) datum though some of the more current maps show (NAD 83) grid ticks. Both the State of Alaska "Land Status Plat" and the Bureau of Land Management "Master Title Plat" use the 1927 North American Datum. Most GPS receivers allow the selection of many datums and referencing geodetic coordinates to the wrong datum can result in position errors of hundreds of meters.

All GPS data must be differentially corrected to remove inaccuracies in the GPS signals This may be accomplished either in real time or by post processing with data from a base station established at a known position in the field or with data from a commercial or government source such as the Coast Guard's RTCM SC-104 signals or a Continuously Operating Reference Station

(CORS) station. The predictable accuracy of uncorrected GPS signals is 20 meters horizontal accuracy and 45 meters vertical accuracy.

a. Data shall be gathered by using either conventional survey and mapping equipment or with differential correction global positioning system (DGPS) equipment and procedures. GPS equipment and software must be capable of obtaining at least 1-meter differential corrected accuracy and be configured with:

   i. Output coordinate datum set to (NAD 83).
   ii. Dilution of precision (DOP) levels set to 8 or less.
   iii. Elevation mask of 15 degrees.
   iv. Position fix mode set to 3D data only (minimum of 4 satellites).
   v. Data collection rate of 1-5 seconds.

b. A minimum of two property corner survey monuments need to be found and DGPS data collected and averaged for at least five (5) minutes at each point. One monument shall be near the beginning and one near the end of the trail. An additional monument shall be found and data collected at each Township crossing. One or more monument ties (or an as-built survey) may be required at change of ownership boundaries. Where required, position data shall be acquired at the nearest monumented corners where a surveyed line separates state and non-state ownership. All such ties shall be made along a property line and the point of intersection stationed. Exceptions may be made where an easement already exists for the trail on the non-state land. If additional monuments are found, collect data for three (3) minutes at each additional point. **For large projects, we recommend that prior to field work a mapping plan be prepared and approved by DNR which identifies the monuments to be tied.**

c. Both hand written field notes and the electronic files from the GPS receivers shall document the fieldwork. The following data shall be entered into the field book:

   i. Field personnel names and weather conditions.
   ii. Dates of fieldwork.
   iii. Receiver and Antenna type used.
   iv. The character and average width of the trail (i.e. 5 feet wide dirt trail with some gravel spots).

d. Additional data to be taken at individual collection points:

   i. Locations, descriptions and rubbings or photos of each monument recovered.
   ii. GPS data File Name.
   iii. Start and end time at the point.
   iv. Antenna height.
   v. Sketch of the site and general description.
   vi. Detailed description of unique features.

2. PROCEDURES FOR ROVER LOCATION OF TRAILS WITHIN STATE LANDS

a. Collect point-positioning data at the starting and ending points of the trail, as per 1.b.

b. If the trail is entirely contained within state lands then:

Set logging interval to:
a) One to five seconds for data capture while walking.
b) One second if moving faster on a vehicle.

c. All locations with unique features shall be a collection point, with DGPS data collected for a minimum of 90 seconds, and described in the field book. (1.d.vi.)

This includes, but is not limited to:
a) Bridges
b) River crossings
c) Lake boundaries
d) Buildings or structures
e) Map or note postings
f) Power / utility line crossings
g) Any feature that may have a reference in another map.

d. Prior to entering a dense forest or an area of poor satellite coverage, point-data collection should take place.

e. Upon leaving an area of poor satellite coverage another point-data collection should take place.

f. Continuous rover data collection over the entire length of the trail should be performed multiple times to cover sections where data was lost due to high DOP or lost satellite lock.

g. If the trail borders other than state lands then a survey by an Alaska Registered Land Surveyor may be necessary. Contact the Department of Natural Resources, Survey Unit to discuss.

3. DRAFTING STANDARDS

The map shall be constructed of good quality paper or other media and be one of two standard sizes: 8 1/2" x 11" or 8 1/2" x 14".

a. The title block, vicinity map, legend, notes, north arrow and graphics shall substantially conform to DNR standards.

b. All line work and lettering on the drawing must be in black drafting ink and must be accomplished with mechanical lettering equipment.

c. All property boundaries of record shall be shown with a narrow solid line. All non-boundary lines such as tie lines and easement limits shall be dashed lines. The standard centerline symbol shall be used for all right-of-way and easement centerlines. The line depicting the trail centerline shall be bolder than any other on the drawing.

d. A vicinity map is required. It shall be at whatever scale is necessary to show the entire trail and clearly indicate section, township, range and geographic information. The vicinity map should be on the first or second sheet as scale and scope of the project dictates. If multiple sheets are required, the vicinity map shall also indicate the coverage by each sheet.

e. If more than two sheets are required the legend and notes shall appear on the first sheet. All sheets shall show the project to scale, DNR's standard title block, ADL number, scale, sheet number, total number of sheets, location by section, township and range.

f. Major topographic features and improvements such as streets, roads, highways, creeks, streams and rivers that will aid in orientation shall be located and labeled on the drawing.

g. Section lines shall be shown whether they are surveyed or not.

h. Ownership of adjacent land shall be labeled (i.e., state, private, Native corporation, etc.), along with the subdivision lot and block designations, U.S. Survey number, tract, ASLS, section, aliquot part, etc. Existing trail easements shall be shown and labeled with Book & Page or Plat Number along with Recording District.

i. The graphics of the drawing shall be oriented so that north is as close as possible to the top of the sheet.

GPS Error Sources

- GPS errors are a combination of noise, bias, and blunders.

  Noise errors are the combined effect of PRN code noise (around 1 meter) and noise within the receiver (around 1 meter).

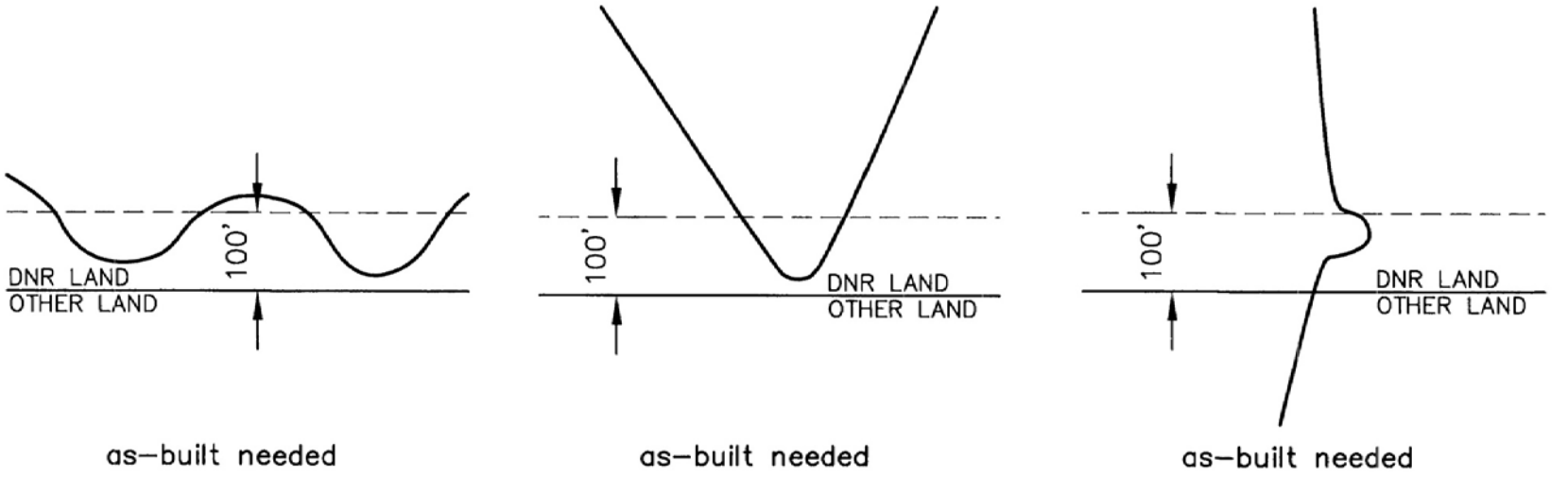
- Bias errors result from other factors:

  A. SV clock errors uncorrected by Control Segment can result in one-meter errors.
  B. Ephemeris data errors: 1 meter
  C. Tropospheric delays: 1 meter. The troposphere is the lower part (ground level to from 8 to 13 km) of the atmosphere that experiences the changes in temperature, pressure, and humidity associated with weather changes. Complex models of tropospheric delay require estimates or measurements of these parameters.
  D. Unmodeled ionosphere delays: 10 meters. The ionosphere is the layer of the atmosphere from 50 to 500 km that consists of ionized air. The transmitted model can only remove about half of the possible 70 ns of delay leaving a ten meter un-modeled residual.
  E. Multipath: 0.5 meters. Multipath is caused by reflected signals from surfaces near the receiver that can either interfere with or be mistaken for the signal that follows the straight-line path from the satellite. Multipath is difficult to detect and sometime hard to avoid.

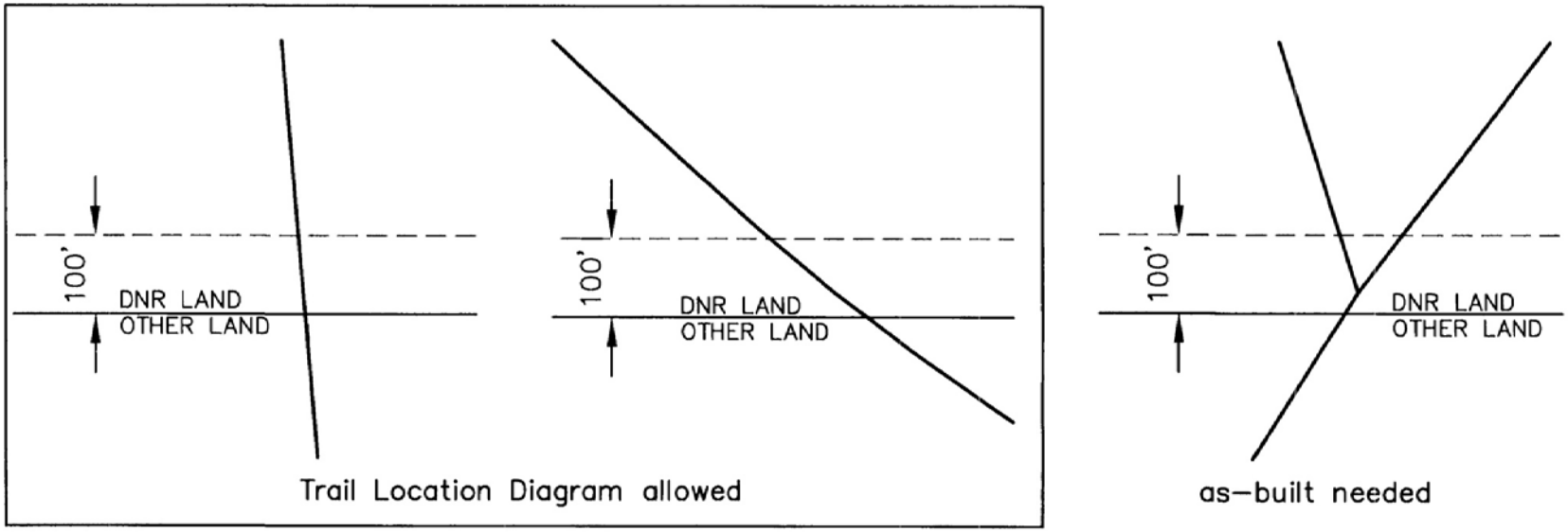
- Blunders can result in errors of hundred of kilometers.

  A. Control segment mistakes due to computer or human error can cause errors from one meter to hundreds of kilometers.
  B. User mistakes, including incorrect geodetic datum selection, can cause errors from 1 to hundreds of meters.
  C. Receiver errors from software or hardware failures can cause blunder errors of any size.

- Noise and bias errors combine, resulting in typical ranging errors of around fifteen meters for each satellite used in the position solution.



These curves may actually be on private property. For trails with identifiable features which are within 100' of a potential conflicting use or property interest, contact the DNR–Survey Unit for instructions.



EXAMPLES OF TRAIL CONFIGURATIONS WITHIN THE 100' WIDE AREA OF UNCERTAINTY

Appendix D: Mapping Software Settings

The following are settings currently used by State Parks as of 2/15/13. Updates in Trimble TerraSync and GPS Pathfinder Office may alter available settings in the future; if this is the case the following settings can still be used as a starting point. To keep data consistent, the Trimble GPS Pathfinder software platform should be used.

The following screen shots are from Trimble TerraSync software (version 3.30) and Trimble GPS Pathfinder Office software (version 5.10), respectively.

D.1 Trimble TerraSync Settings

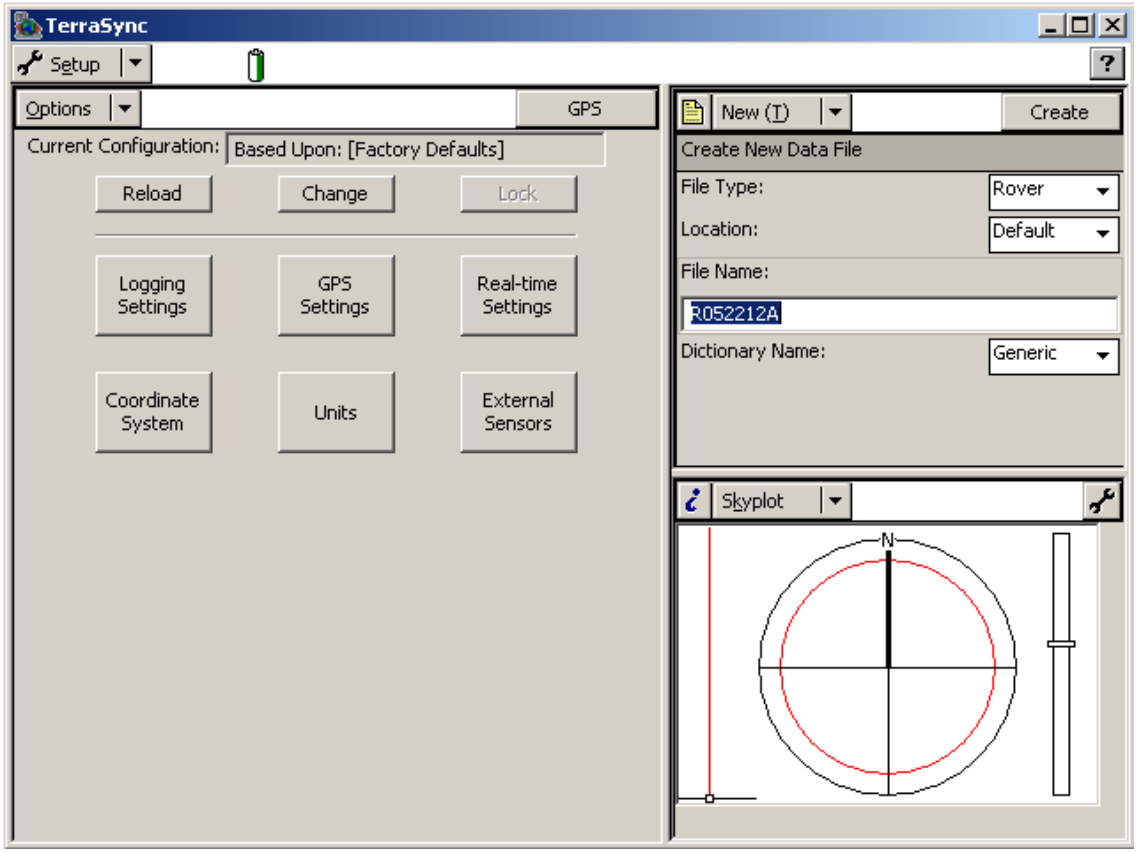


Figure D.1 – Setup Window

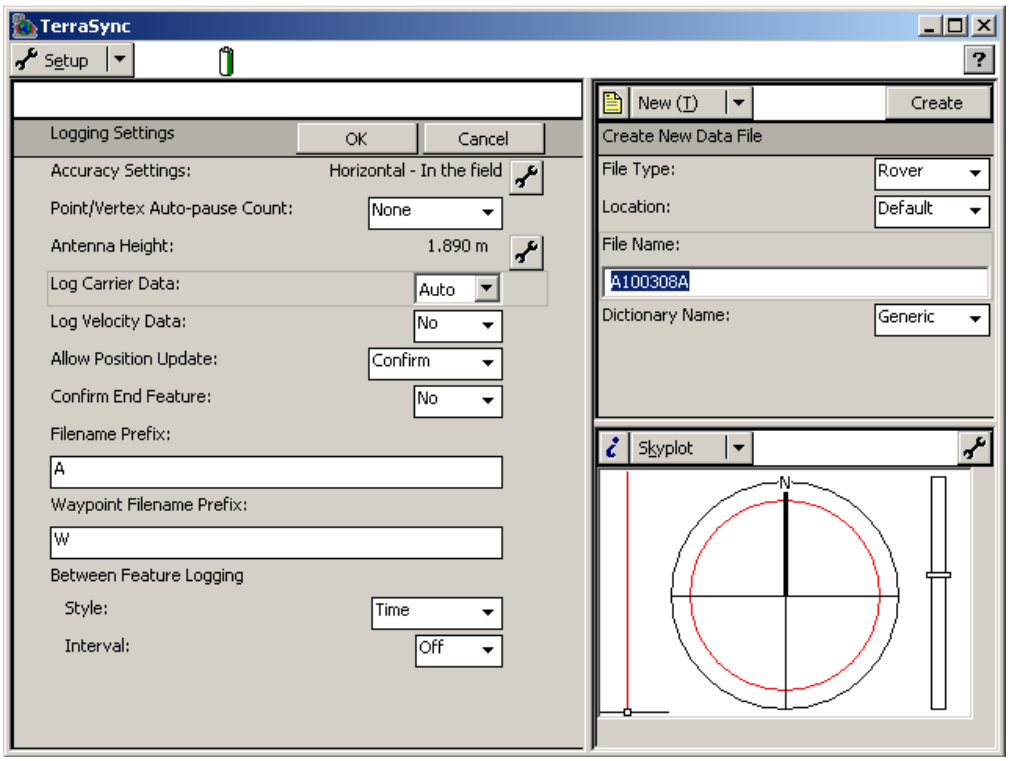


Figure D.2 – Logging Settings Window

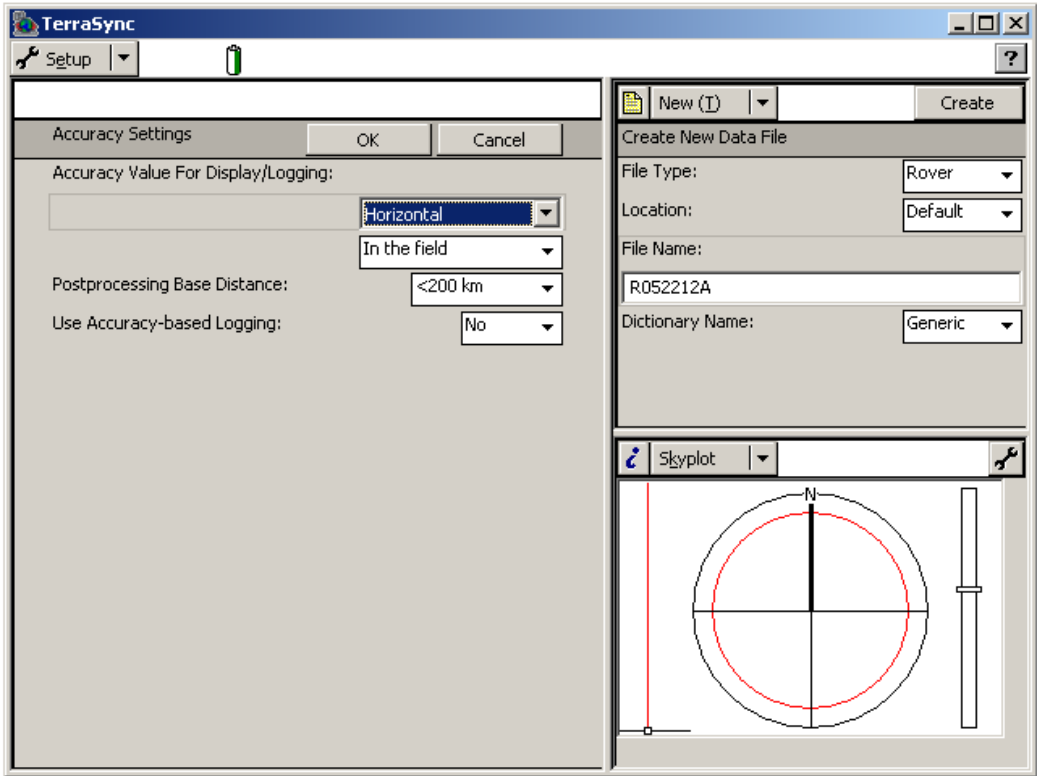


Figure D.3 – Accuracy Settings Window

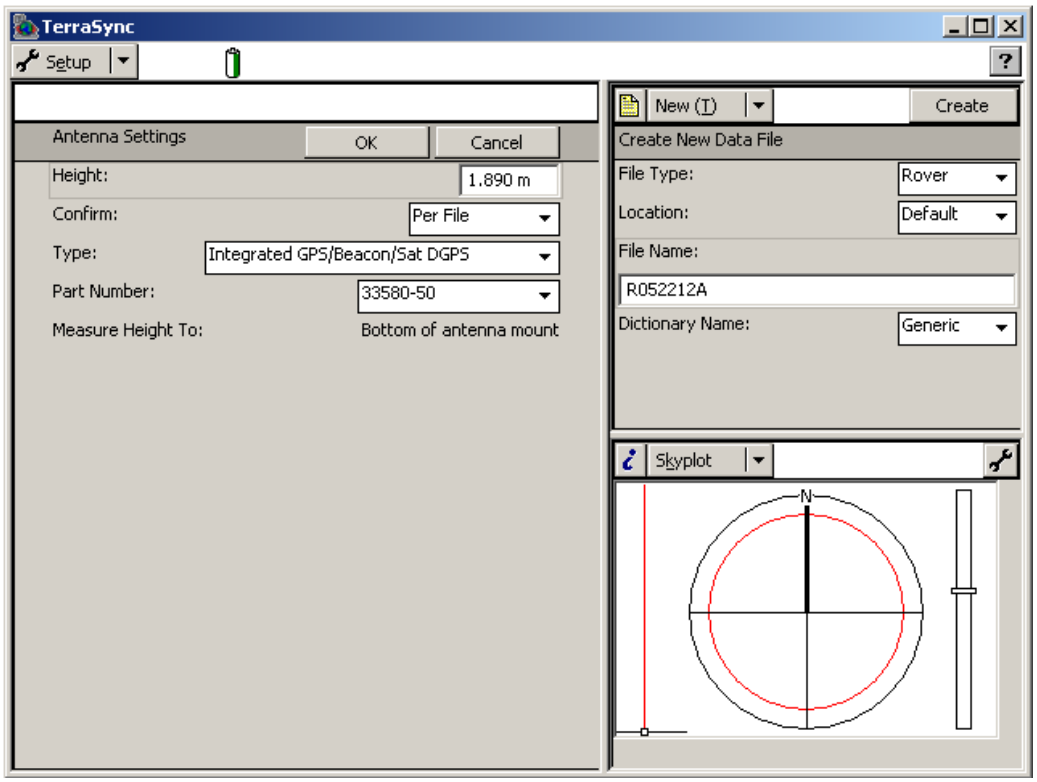


Figure D.4 - Antenna Settings Window

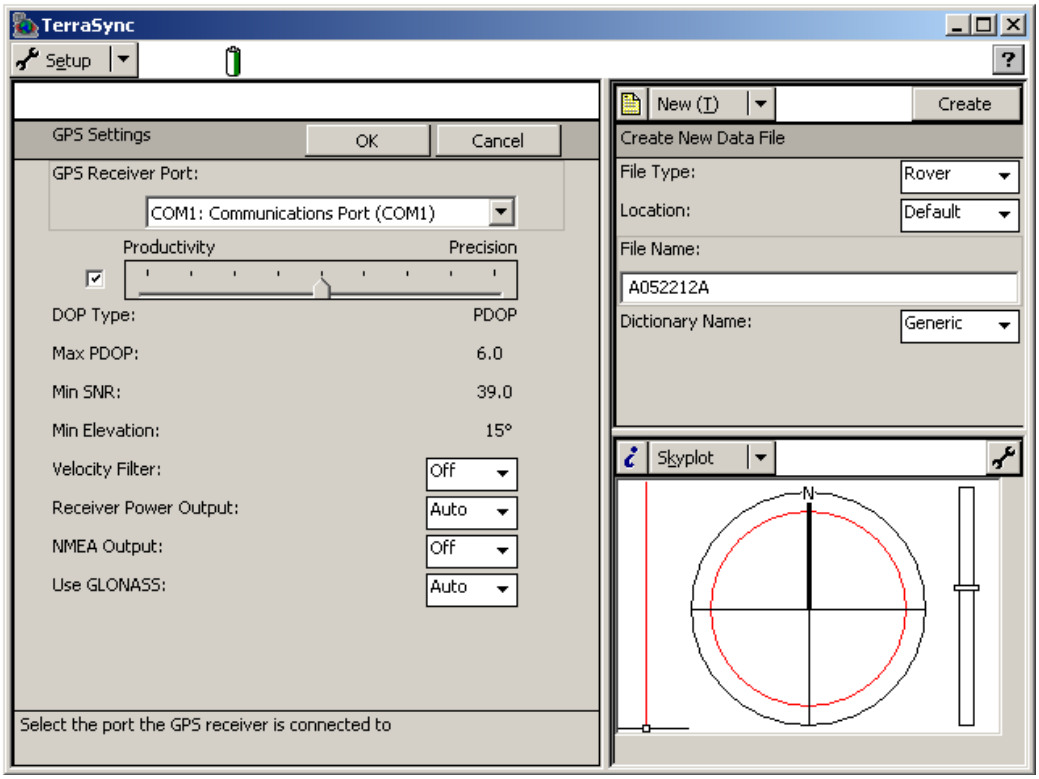


Figure D.5 – GPS Settings Window

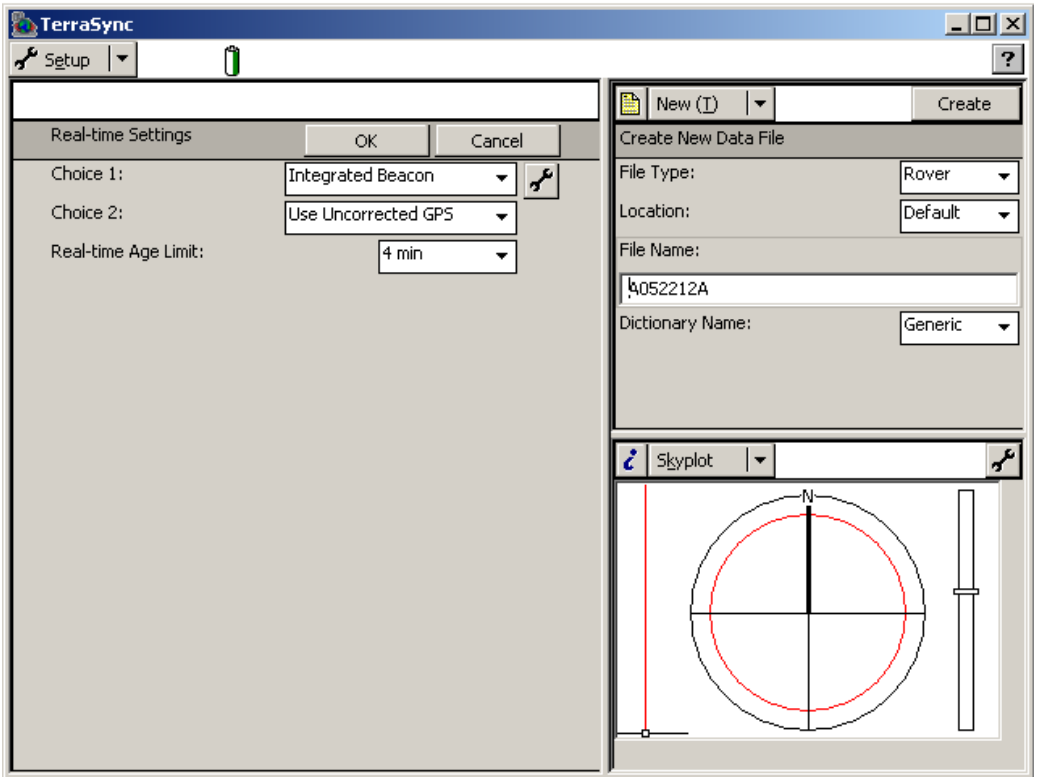


Figure D.6 – Real-time Settings Window

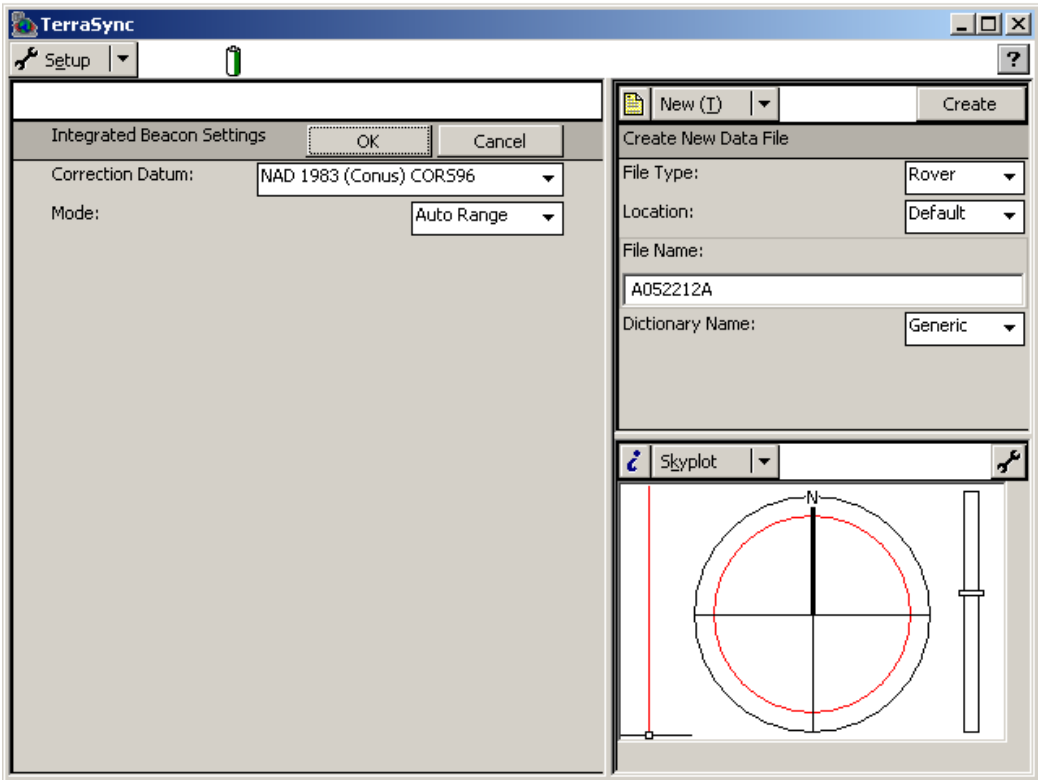


Figure D.7 – Integrated Beacon Settings Window

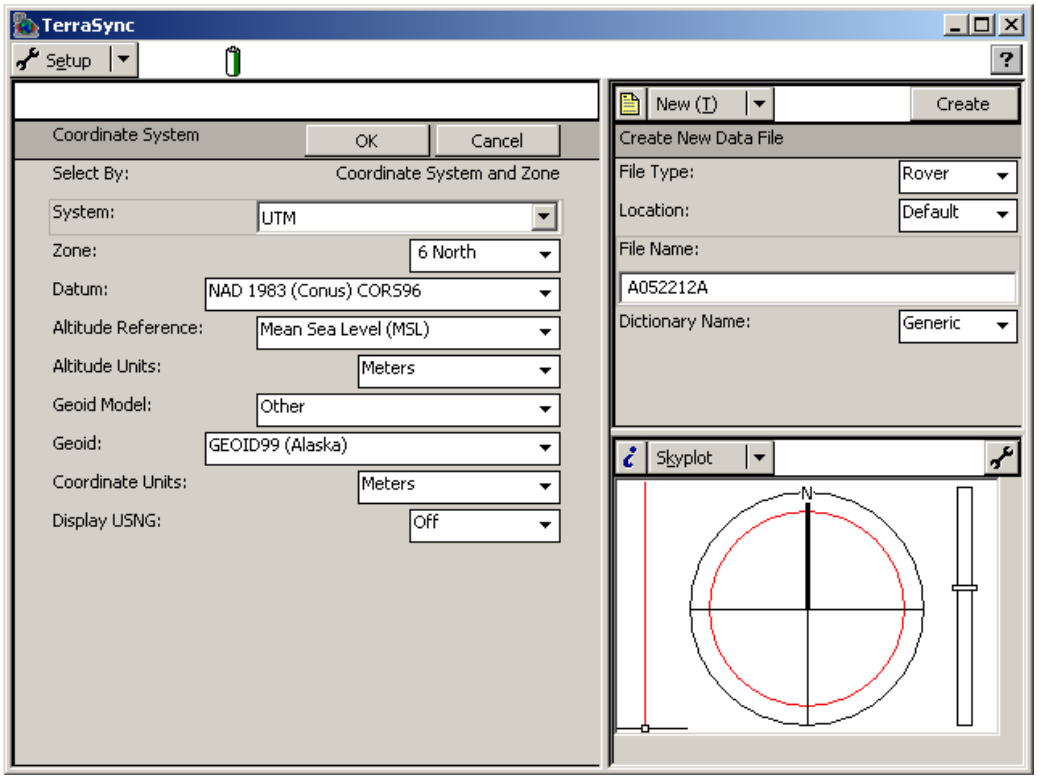


Figure D.8 – Coordinate System Window

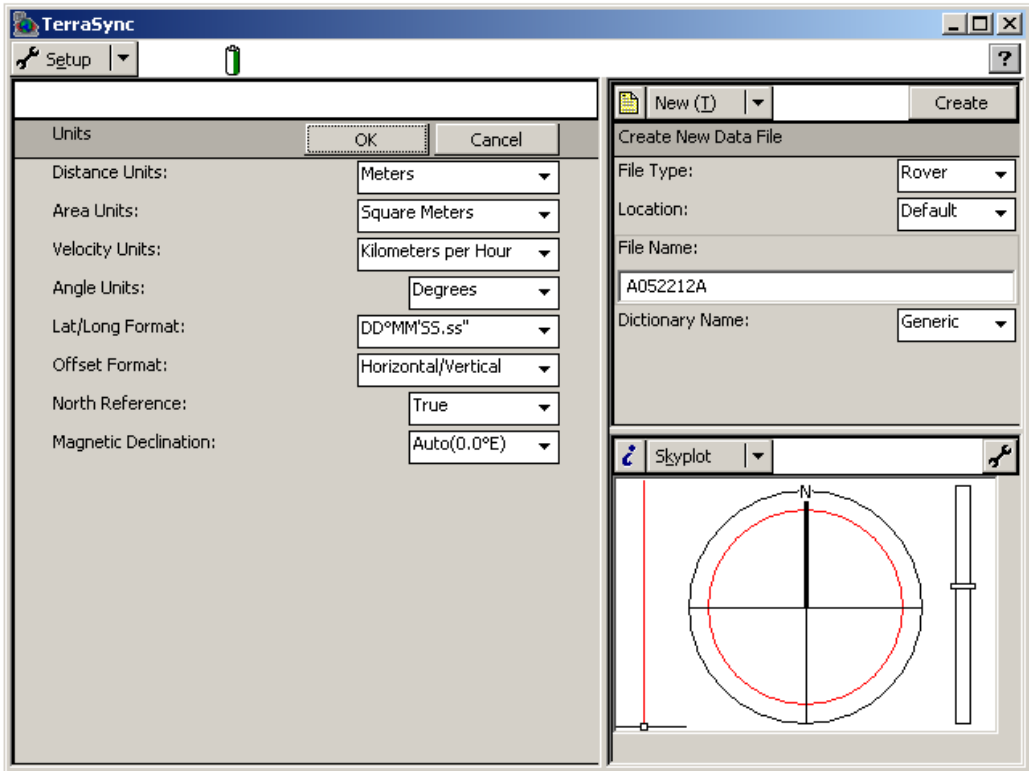


Figure D.9 – Units Window

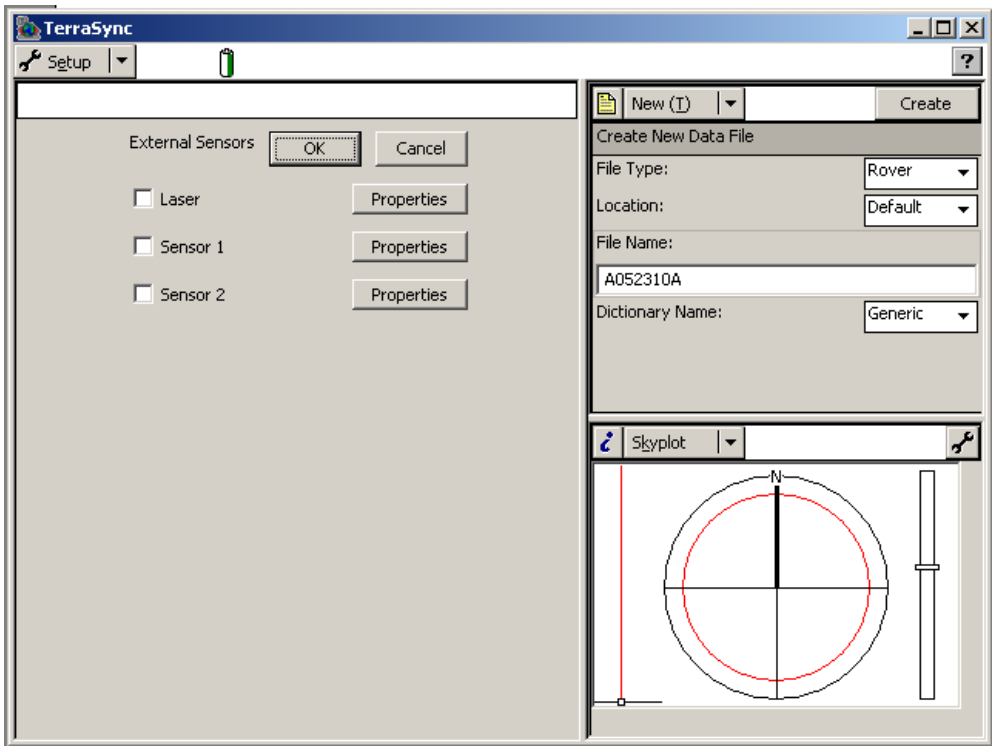


Figure D.10 – External Sensors Window

D.2 Trimble GPS Pathfinder Office Export Settings

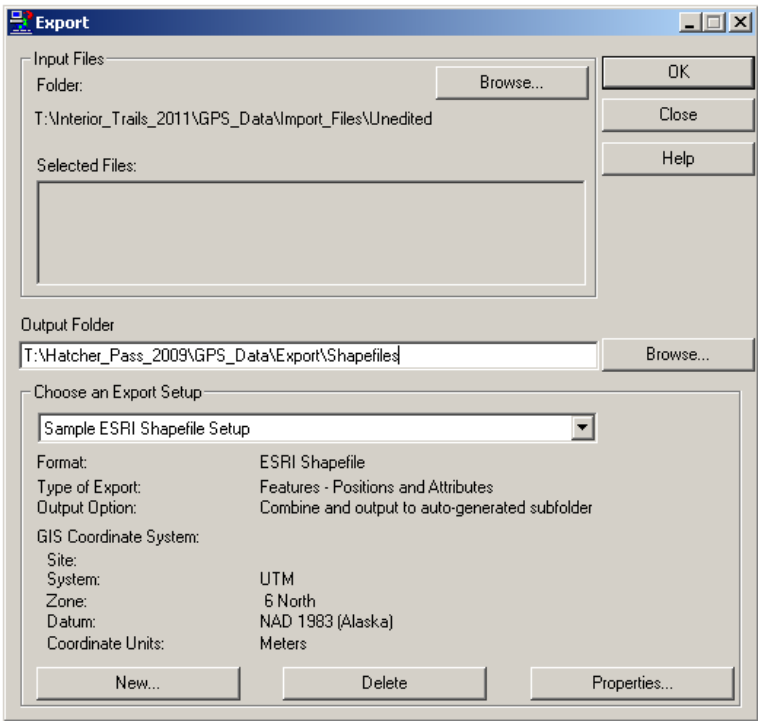


Figure D.11 – Export Main Window

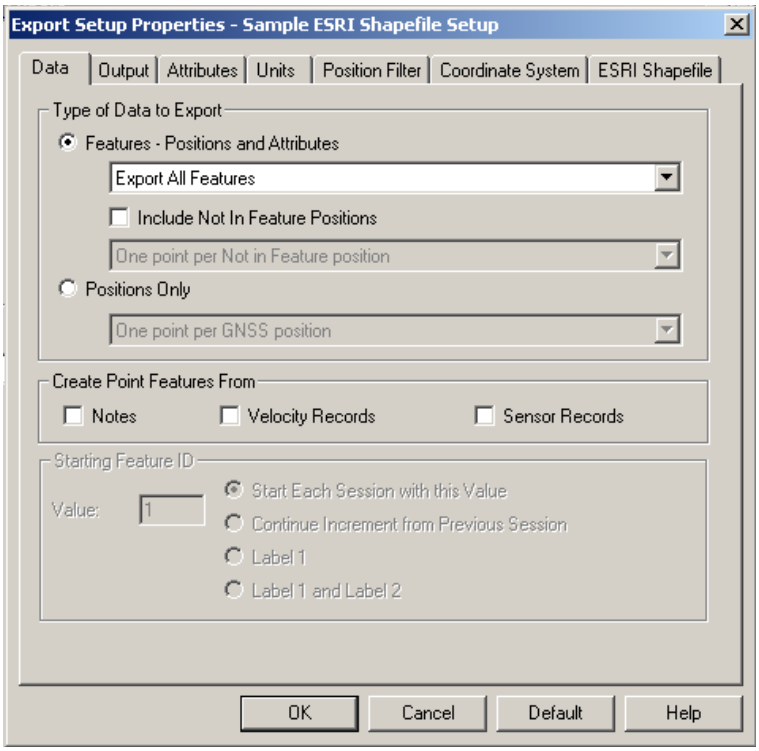


Figure D.12 – Data Window

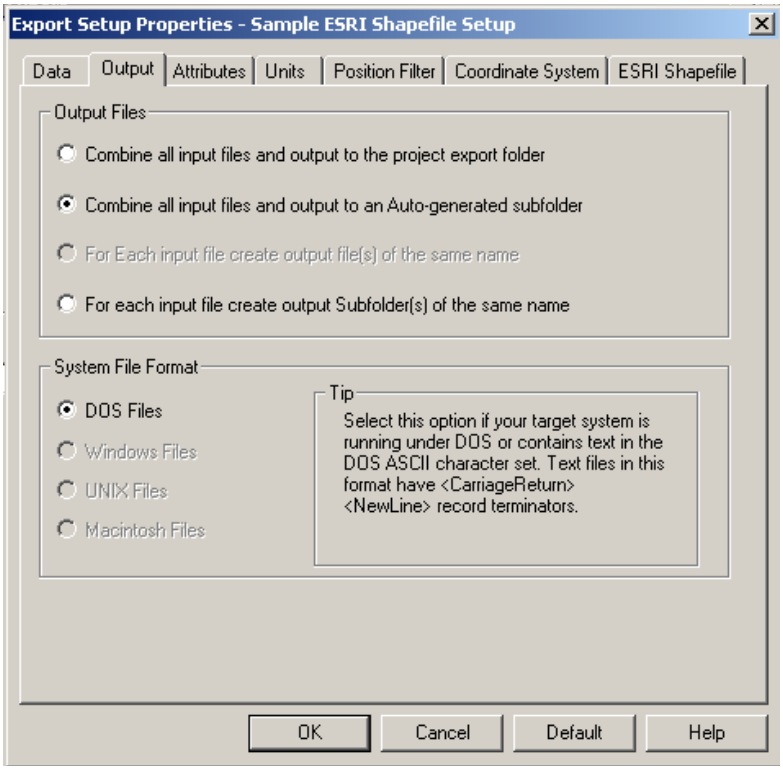


Figure D.13 – Output Window

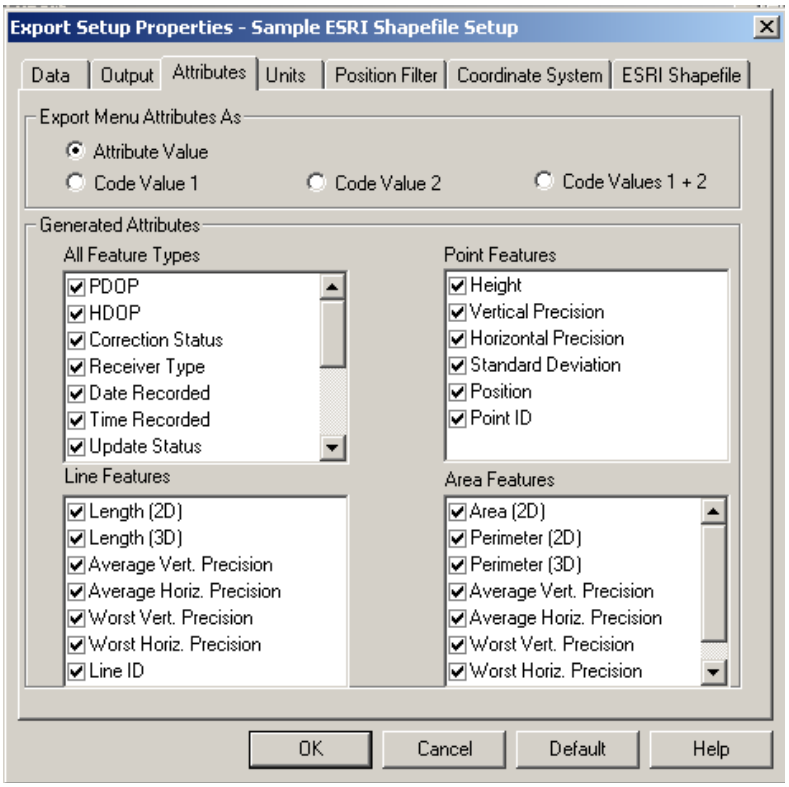


Figure D.14 – Attributes Window 1

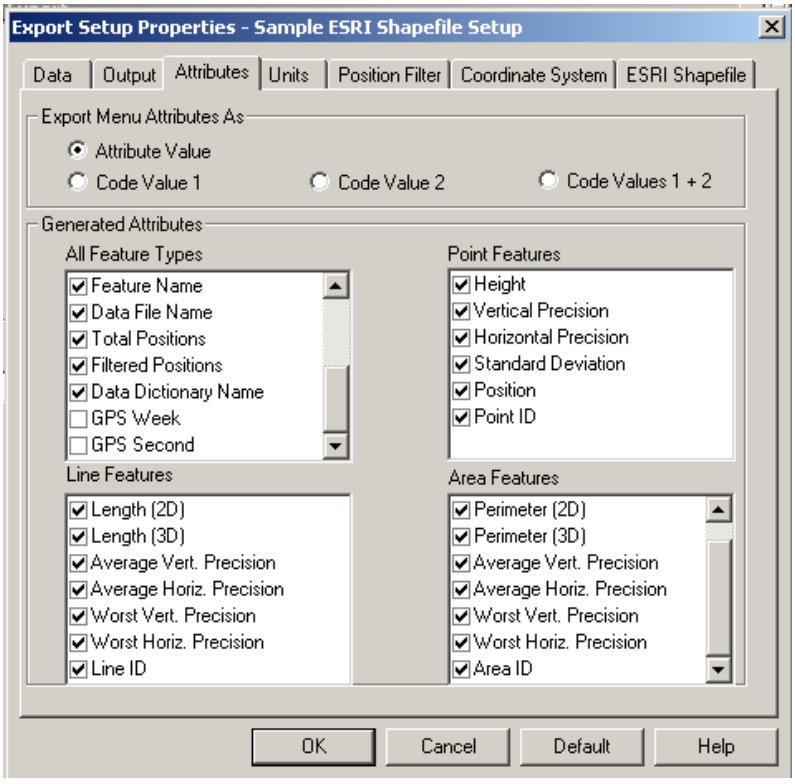


Figure D.15 - Attributes Window 2

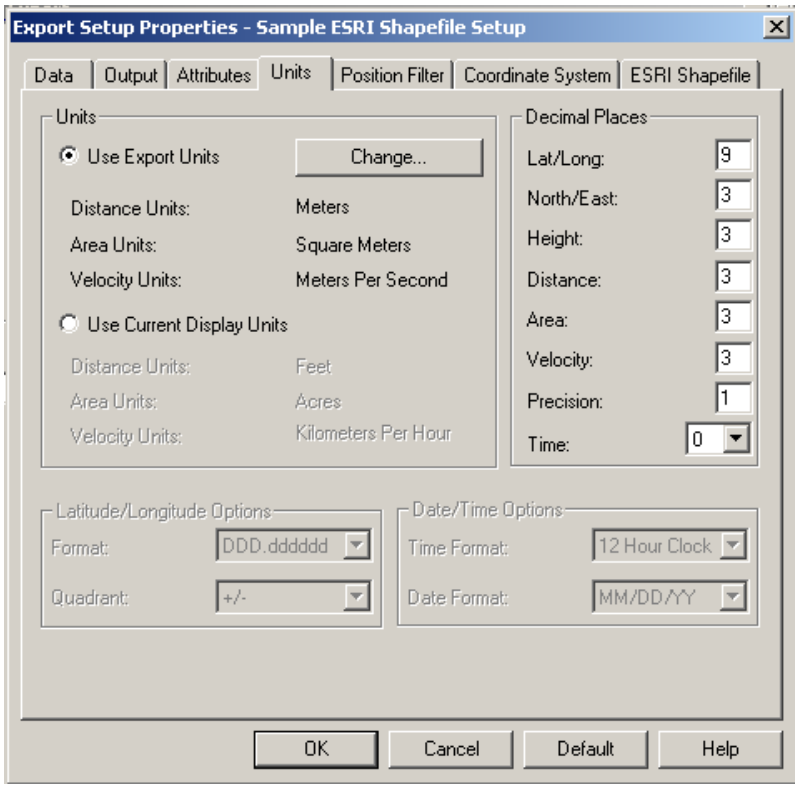


Figure D.16 – Units Window

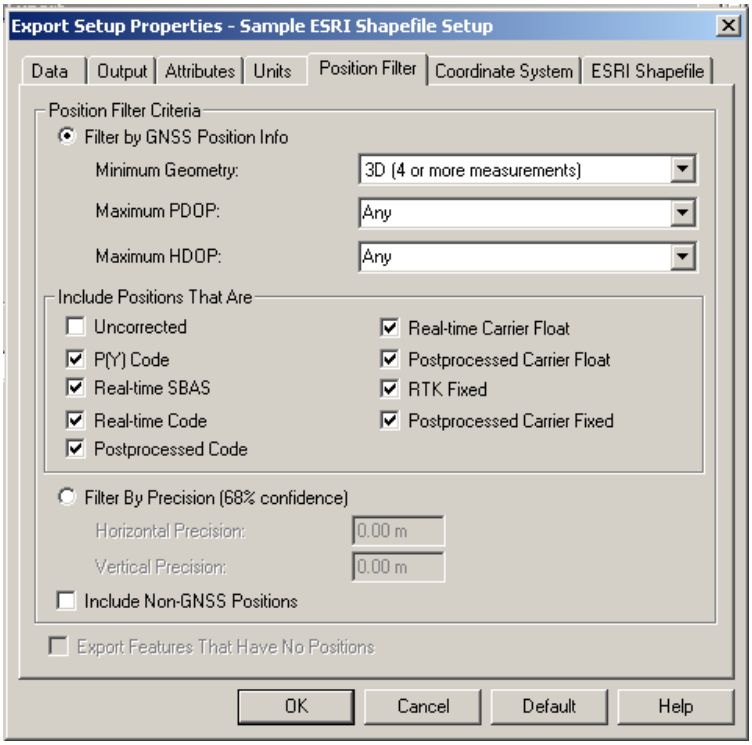


Figure D.17 – Position Filter Window

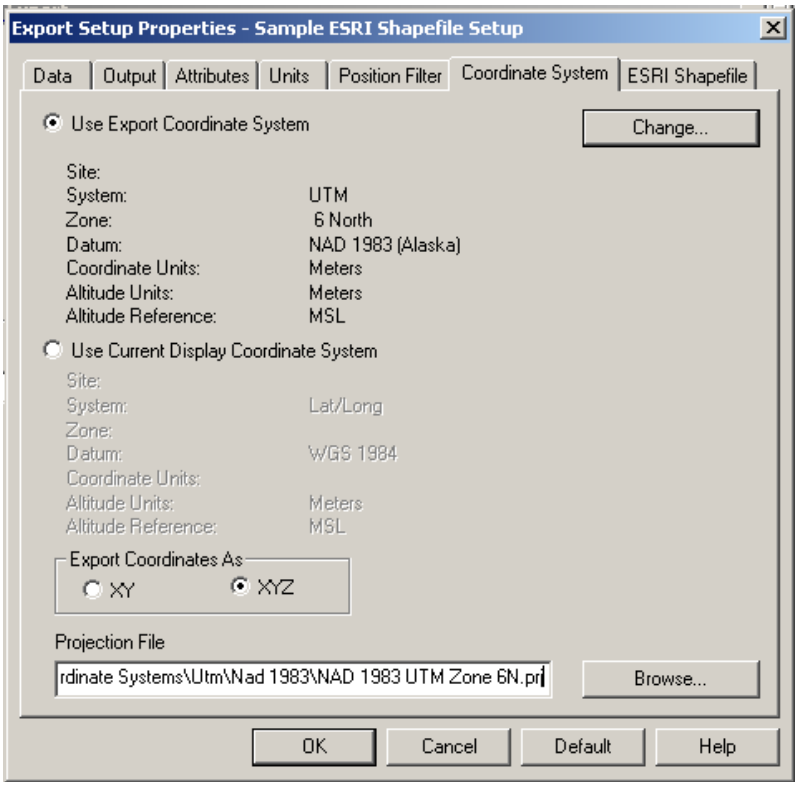


Figure D.18 – Coordinate System Window

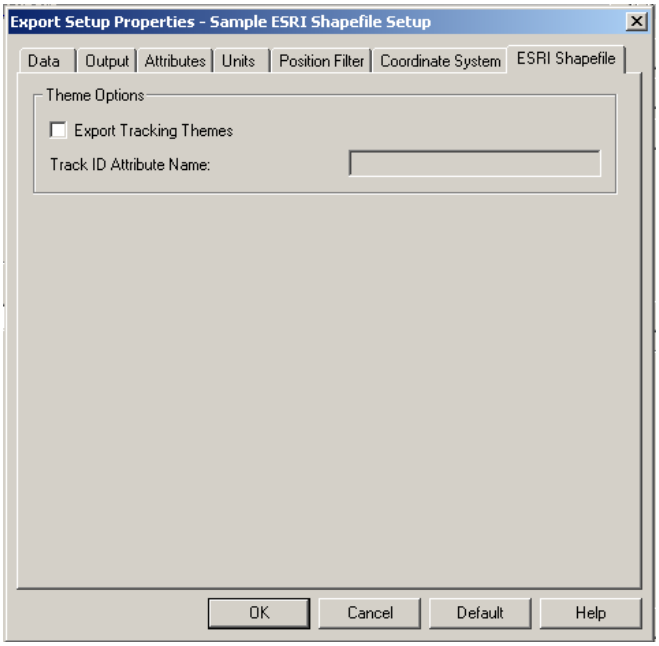


Figure D.19 – ESRI Shapefile Window

D.3 Trimble GPS Pathfinder Office GPS-Photo Link Export Settings

The only settings that differ from the previous export settings are in the Attributes tab.

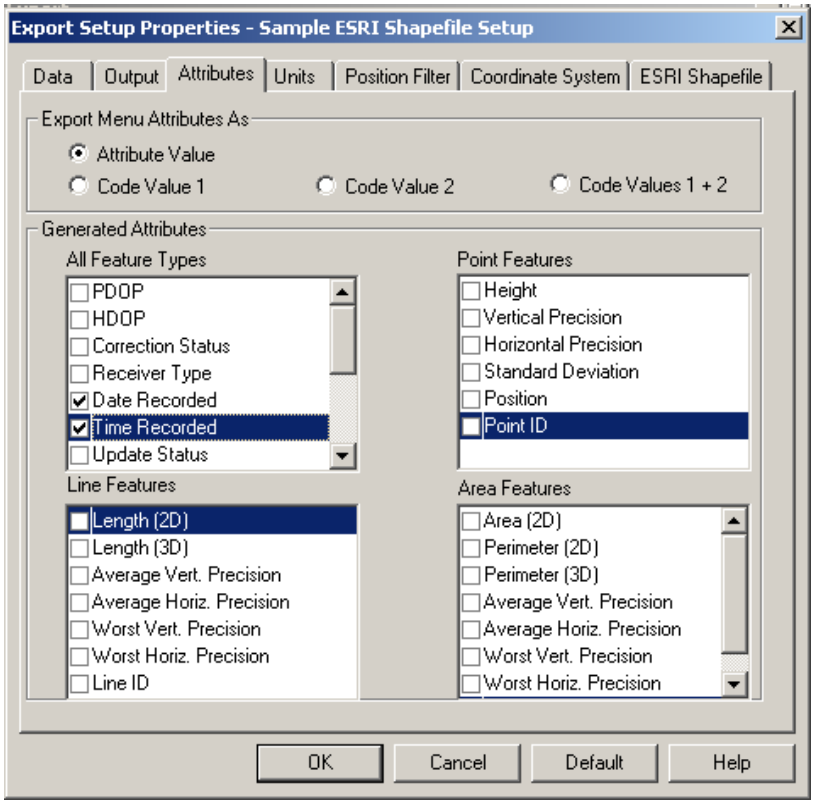


Figure D.20 – Attributes Window 1

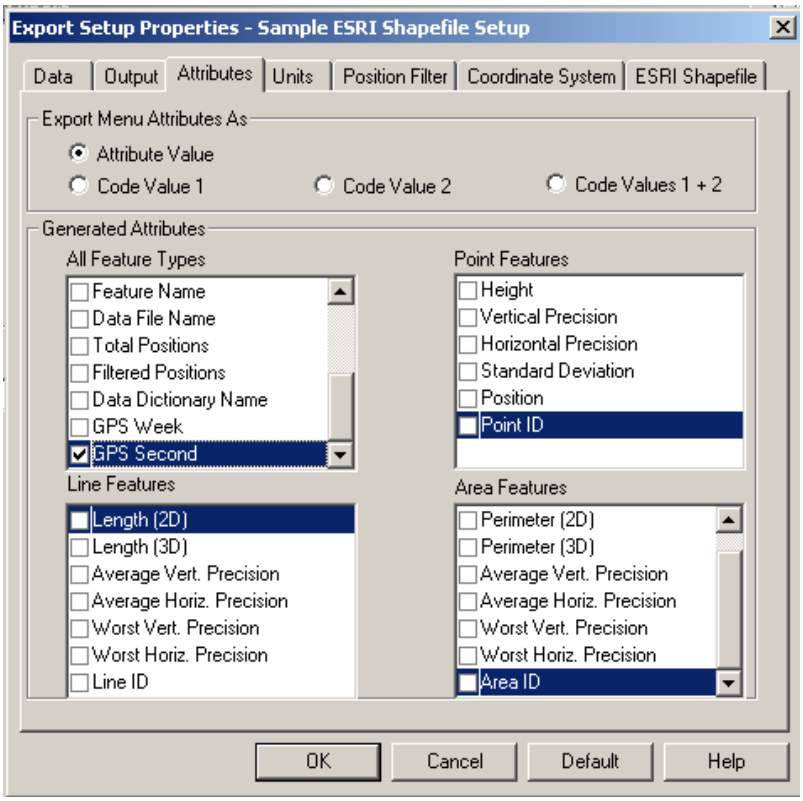


Figure D.21 – Attributes Window

Appendix E: Trail Terminology

The following is a list of trail term definitions that are used throughout this handbook. In part, they parallel terminology used by the US Forest Service, the US Fish and Wildlife Service, the National Park Service, and the Bureau of Land Management. An additional glossary of trail terms is available at: www.americantrails.org.

All-Terrain Vehicle (ATV) – See Off-Highway Vehicle (OHV).

Accessible: A term used to describe a site, building, facility, or trail that complies with the Americans with Disabilities Act (ADA) Accessibility Guidelines and can be approached, entered, and used by people experiencing disabilities.

Anchor: An object, usually vertical, such as a tree or stone, which defines the sides of a trail and helps to keep users in the center of the tread. Also an object used to hold another in place.

Backslope: The *backslope* of the trail is the excavated slope above the trail *tread* and below the natural hillside; ideally less than or equal to the natural angle of repose of the excavated material.

Batter: The inward tilt of *retaining walls* or similar structures.

Berm: A small ridge of material accumulated along the outer (critical) edge of the tread from a combination of compaction, erosion, and displacement occurring along the centerline of the tread surface. The Berm is undesirable in that it channels water along the tread surface. It is often slated for removal during maintenance.

Best Trail Management Practices (BTMPs): A series of management components developed to reflect the current "state-of-the-art" practices for effective and efficient trails management.

Bog Bridge: A simple trail structure that consists of treated timber planks resting on sleepers. For areas that gain elevation the *step and run technique* can be used; use spacers to elevate the planking on steeper terrain.

Braided Trail: Problem areas along a trail where multiple parallel paths develop, usually around steep, wet, or otherwise degraded areas.

Bridges: Appropriate for stream large stream crossings that may otherwise be dangerous to ford, or have high peak flows. They can be a complex engineering project or as simple as a log with a hand rail.

Causeway: A type of wetland trail structure that consists of raised tread without drainage ditches. *Stepped turnpike* can be used on steeper slopes by creating steps using rock or log retainers.

Chaps: Chaps are buckled over trousers with a synthetic protective barrier to protect the front of the legs when using a chainsaw. Inside the protective barrier is Kevlar, which unravels within the chain if contact is made.

Check-Dam: A structure to slow down water flow and trap sediment; often used when reclaiming decommissioned trails.

Climbing Turn: A gradual turn that can help a trail climb faster than a straight sustainable grade alone. A short section will be *fall line*.

Clinometer: A tool used to determine grades and slope angles.

Contour: Line of equal elevation on topographic maps.

Control Point: A specific point, area, or feature that is important in trail layout. *Positive control points* are places you want the trail to go to or near (such as trailheads, scenic points, good water crossings, other trails, etc.). *Negative control points* are places you want to stay away from (such as hazards, sensitive habitat, private property, etc.).

Crib Walls: A retaining device used to support the trail tread or *backslope* using stacked and notched logs.

Culvert: A conduit to deliver a small volume water beneath a trail; this can be accomplished with plastic or metal piping or rock structures. Wood is not durable and isn't recommended. See Appendix A: Sheet 12.

De-berm: To remove the berm on the downhill side of the tread during trail maintenance.

Differential GPS (DGPS): A GPS receiver that uses real-time or post-processed corrections to increase accuracy to one meter or less.

Digitizing: Tracing a physical feature from topographical maps or satellite/aerial imagery in ArcMap software to create a GIS layer.

Durable Tread Surface: The tread surface of a trail should be compacted and durable enough to support the managed use and shed water.

Fall Line: The steepest route of descent down a slope. Water flowing down a hillside will travel along the *fall-line*.

Flagstone Paving: A method of *trail armoring* that involves placing large flat stones on mineral soil (organics removed from surface), or a mix of aggregate.

Full Bench Trail: The tread is cut the tread entirely from the hillside from compacted soils, resulting in a stable tread.

Geocell: A honeycombed plastic *geosynthetic* that can be used to hold soils in place when the soils are wet.

Geosynthetics: are man-made materials that help stabilize soils or prevent native soil and the tread surface from mixing.

Geotextiles: (Geotex) A type of *geosynthetic* keep layers from mixing, while allowing water to drain through.

GIS (Geographic Information System): Geography software used in State Parks mapping. ESRI ArcMap is the brand that State Parks uses, although there are others available.

GIS Layer: A file that holds geographic information in GIS. It will usually be a geodatabase (.gdb or .mdb), shapefile (.shp), or raster (often .tif, though many formats exist), although older coverages may be encountered.

Grade Reversals: These are areas at which a climbing trail levels out and then changes direction, dropping subtly a short distance (20-50 feet) before rising again.

Half Rule: Trail grade should not exceed ½ the *sideslope* that the trail traverses; if so, it becomes a *fall-line* trail.

Keystones: Large heavy rocks used as anchors in *trail armoring*.

Kickrail: A wooden sill installed on puncheon's decking to guide walkers' feet.

Knick: five to ten foot semi-circular sections of trail that are shaved down to a 15% outslope; they are added to divert water from a ponded area on a trail.

Leadoff Ditch: Drainage structure to draw water away from a trail.

Managed Use: The modes of travel that are actively managed and appropriate, considering the design and management of the trail (i.e. biking, snowmobiling, hiking, etc.).

Maximum Sustainable Grade: This is the defined maximum tread grade that can be constructed along the trail. This is typically restricted to runs of less than 50 feet, and no more than 5% of total length of the trail.

Outslope: This is the downhill tilt of the trail. As the trail contours across a hillside, the downhill or outer edge of the tread should tilt slightly downhill and away from the uphill trail edge. Under typical circumstances, this *outslope* should be less than 5%.

Partial Bench Trail: In Partial Bench construction, only part of the tread is created by digging into the hillside; the rest of the tread surface is created from compacted excavated

soil. This method is not recommended because the outer tread will not be as durable as the inner tread. It may be necessary when encountering some obstacles.

Puncheon: A raised wetland trail structure that uses *sleepers* (simple foundation for trail structures using planking) *stringers* and wood planks to elevate decking above wet soils.

Punji Stick: sharp stick coming out of the ground or from a tree that can be hazardous to trail users.

Raised Tread Construction: A construction method that can be used to stack tread above wet ground. Large rocks are placed into mineral soil, a layer of smaller rocks is placed above, and capped with aggregate.

Retaining Wall: A structure made of rock to help support tread. These are often used to support *turning platforms* of *switchbacks*, and *partial-bench construction.*

Rolling Contour Trail: ***A*** Rolling Contour Trail encourages water to flow off of trail tread by gently traversing a hillside and incorporating *grade reversals* and *outslope* into their design.

Rolling Grade Dip: A *rolling grade dip* uses the soil from a *knick* to build a ramp on the downhill side of the *knick*

Scarification: Churning compacted soil to allow vegetation to grow; often done when reclaiming decommissioned trails.

Sleeper: Log or timber used as a foundation for *bridges* and *puncheon*; wood planking or stringers rest on *sleepers*.

Stone Pitching: The process of skillfully placing stones on end into the ground, carefully aligning rock joints. This makes a durable trail surface.

Stream Ford: An armored crossing that uses large stones to increase the durability of a stream crossing and its entrances.

Stringer: Structural support for a *bridge* that spans the width of the stream.

Sustainable Trail: A “sustainable trail” is defined as a trail that conforms to its terrain and environment, is capable of handling its intended use without serious resource degradation, requires minimal maintenance, and focuses on maximizing the user experience. This involves the use of integrated water control, curvilinear layout, grade control and full bench construction.

Switchback: Switchbacks allow a trail to climb steeper than a Climbing Turn will allow. Switchbacks avoid fall line sections by constructing *turning platforms*. A sharp turn in the tread alignment used to gain elevation on steep side slopes (typically required on

slopes above 22%). Switchbacks are a highly technical trail structure and should be avoided in favor of *climbing turns* (for slopes less than 22%) when possible.

"Three-Cuts" Method: Using this method of pruning is encouraged to keep bark from peeling off of a tree when its branch is removed. First cut from the bottom several inches from the bark collar to remove the bulk of the branch. Next, cut from the bottom just outside of the branch's bark collar. Finish cutting through the branch from the top.

Trail Armoring: Reinforcement of a tread surface with a resilient material such as rock, stone, or concrete.

Trail Class: The prescribed scale of trail development, representing the intended design and management standards of the trail. Trails can be *class 1* (minimal/undeveloped) through *class 5* (fully developed trail).

Trail Layout Marking: Staking or flagging the location on the ground after designing a trail. *Center line method:* Pin flags are placed in the center of the trail tread. A defining line is cut through the organic layer half the tread width on the uphill side to aid in trail construction. *Uphill edge method:* Flags mark the uphill edge of the tread. A line is cut through the organic layer on the lower boundary of the tread. *Downhill (critical) edge method:* The downhill edge is marked with pin flags. A line is cut through the organic layer on the upper boundary of the tread.

Trail Management Objectives (TMOs): A document written to help manage a trail, influencing how individual trails will be developed, used, and maintained. A properly written TMO can be used to identify the types of use that will occur on a trail, how much use it is expected to receive, and how much maintenance will be required once it is built. Specifically, TMOs document *designed use*, *managed use*, and *design parameters* for both planned and existing trails. For existing trails, TMOs can be an effective tool to determine if a trail is being properly managed or if it is meeting intended standards or objectives.

Trail Profile: A graphical representation of elevation gain and loss over the course of a trail.

Trail Type: A fundamental trail category that indicates the predominant trail surface or trail foundation, and the general mode of travel the trail accommodates. The Trail Type can be *terra* (standard), *snow*, or *water*.

Tread: The top layer of a trail; the surface that people walk/ride on.

Turning Platform: A platform constructed for a *switchback***.**

Turnpike: A type of wetland trail structure that consists of raised tread and drainage ditches on each side. *Stepped turnpike* can be used on steeper slopes by creating steps using rock or log retainers.

Waterbar: An abrupt raised feature on a trail designed to drain water off of the trail tread. Avoid using them, because they require maintenance, people often walk around them, and they easily fill with sediment.

Appendix F: Trail Management Policy

Policy and Procedure
Division of Parks and Outdoor Recreation
Department of Natural Resources
State of Alaska

Number: 60200

Total Pages: # 5

Subject:
TRAIL MANAGEMENT POLICY

Authority: Director

Approval:

Signature of Director

3/10/09
Effective Date

Distribution:
Director
Section Chiefs
Area Superintendents
District Rangers

Dates of Previous Versions:

Introduction:

The Alaska Division of Parks and Outdoor Recreation is responsible for approximately 67 trails, comprising more than 650 miles (not including water trails) within 128 units of the State system. These trails are very important to Alaskans. According to a public recreation survey, seven of the top ten favorite activities of Alaskans involve trail usage (SCORP, 2004). This same survey found that the majority of respondents indicated that trail rehabilitation, upgrades, and expansion should be a high priority for the State.

The *Division of Parks and Outdoor Recreation Ten-Year Strategic Plan 2007-2017* reports that the deferred maintenance backlog for park facilities (which includes trail operations) is over $67 million. Funding tends to focus on the high-use front-country areas, where most management and public safety problems occur. For this reason, trail programs tend to receive little attention other than "basic" maintenance, such as removing fallen trees or other minor repairs, and almost no preventive maintenance. Often, trail operations have been viewed as a non-technical element of overall park operations and little emphasis has been placed on formal training for staff involved in trail programs. In most cases, staff has been provided with limited direction and guidelines and few training opportunities. This has proved detrimental as improperly built and maintained trails are in some cases inadequate for their current uses, and can lead to park resource damage.

Purpose:

This Trail Management Policy will provide direction on how the Division will manage, develop, maintain and assess the condition of its trails. It is designed to provide the overarching framework guiding sustainable and responsible trail development and management. To complement this policy the Alaska State Parks Trail Management Handbook has been created to provide greater detail on how to design, construct and maintain trails using standards, guidelines and best management practices.

The five primary goals of this policy and the Alaska State Parks Trail Management Handbook include:

1. Standardize ***sustainable*** trail construction and maintenance techniques.
2. Organize a process to assess, prescribe and prioritize State trail system needs.
3. Promote wise management of Alaska State Park trail resources through proper planning, design and training.
4. Achieve long-term savings in maintenance costs.
5. Provide reference resources to the public, other organizations and park staff to establish, promote and enhance sustainable trail systems throughout the State.

These goals will be carried out through the creation, use and in some cases adoption of the following trail management concepts:

1. Trail Management Objectives (TMO's)
2. Trail Classification System
3. Best Trail Management Practices (BMP's) through use of the adopted "Sustainable Trail Framework"
4. Trail Inventory and Assessment (through GIS / GPS application)
5. Standardized Trail Dictionary

1. Trail Management Objectives

Trail Management Objectives (TMO's) are defined as the documentation of the intended purpose and management strategies of a trail based on the trail vision. TMO's document the Trail Class, Designed Use, Design Parameters, and other trail-specific considerations for both planned and existing trails. TMO's also provide information for subsequent trail planning, management and reporting purposes.

All Alaska State Park's *managed trails*[1] will have TMO's developed based on management plan direction and a trail's specified Designed Use. Absent of a management or trail plan, TMO's will be developed with consideration given to how individual TMO's accommodate the public needs, protect resources and are sustained into the future.

See Section 1 of the **Alaska State Parks Trail Management Handbook** for the Trail Management Objective form and instructions.

[1] *See the Alaska State Parks Trail Management Handbook for a formal definition (Trail Use Strategies and Managed use)*

2. Trail Classification System

A Trail Classification System provides uniform standards for trail nomenclature, maintenance, marking, design, and construction. The Trail Classification System adopted by this policy is a close adaptation of the National Trail Classification System that has been formally adopted by most federal land management agencies, and therefore will be a major step forward in applying consistent terminology and management guidance on trails across Alaska. This system is based on identifying the standardized category (Type and Class) of an existing or planned trail.

Two general types of trails will be referenced in the Alaska State Parks Trail Management Handbook: Standard Terra Trails and Snow Trails. Each trail, regardless of type, is further broken-down into one of five Trail Classes, ranging from least developed (Trail Class 1) to most developed (Trail Class 5). General criteria are supplied to define Trail Classes applicable to all system trails. Trail Classes are further refined through Trail Design Parameters that offer construction specifications by the type of trail use, such as hiking, biking, all-terrain vehicle, and snowmobile trails. Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail.

See Sections 2 and 3 of the **Alaska State Parks Trail Management Handbook** for Trail Classification Criteria and Design Parameter Matrices.

3. Best Management Practices (BMP's) for Trails through use of a "Sustainable Trail Design Framework"

A Sustainable Trail is most simply defined as a trail that conforms to its terrain and environment, is capable of handling its intended use without serious degradation, and requires minimal maintenance.

Trail sustainability is designed around the following four design fundamentals:

- Integrated Water Control
- Curvilinear Layout
- Grade Control
- Full Bench Construction

The foundation of sustainable trail construction focuses on initial trail design to prevent future resource degradation and human impacts. While initial construction costs are typically higher, overall life-cycle costs will be reduced with lower maintenance costs as well as minimizing resource degradation in the future. Integral to sustainability is proper trail planning – a sound plan is the core for any successful trail project. Additionally, a Sustainable Trail integrates well into its environment; it does not destroy the feel, aesthetics or ecological integrity of the environment.

The Division adopts these core fundamental sustainable trail design concepts and will integrate them into its trails program. While some elements may be difficult or impossible to

fully implement without major expense, all reasonable measures shall be implemented whenever feasible. This policy mandates that the "Sustainable Trail Design Framework" be incorporated as follows:

- **New Trails** – All new Division trails will be built using the "Sustainable Trail Design Framework" as part of their design standard. No new trails will be constructed without adherence to this standard.

- **Existing Trails** – As trails are repaired, re-routed or otherwise upgraded, they will be built to sustainable levels when feasible.

See Section 4 of the **Alaska State Parks Trail Management Handbook** for reference to the adopted "Sustainable Trail Design Framework".

4. Trail Inventory and Assessment System

Before trail maintenance and repair strategies can be fully developed, an assessment of trails and their condition will be made based on the TMO's developed for each trail. While TMO's provide a vision for *future* trail conditions, Trail Assessments will offer an accurate snapshot of *existing* conditions and what is needed to meet sustainable standards. Differences identified between a TMO and Trail Assessment will expose those areas where shortfalls and gaps exist. Corrective measures and rehabilitation efforts to address identified shortfalls shall utilize sustainable trail concepts and best practices. Information derived from assessments and evaluated against sustainable standards and guidelines will also aid in the determination of how a trail may be best managed given its current state.

It will be Division policy to collect an inventory and assessment of all managed trails to determine the condition and immediate need of park trail systems. Alaska's Minimum State Mapping Standards will be applied for the creation of mapping documents, as listed in the Alaska State Parks Trail Management Handbook. It is also mandated that all data collected will conform to the newly developed Interagency Trail Data Standards. Universal trail data standards will enable national, regional, state, and trail-level managers and the public to use mutually understood terminology for recording, retrieving and applying spatial and tabular information. Data standards will make it easier for trail information to be accessed, exchanged and used by more than one individual, agency or group. Any data collected for the Division shall be exchangeable and functional for other partner agencies and public use.

See Section 5 of the **Alaska State Parks Trail Management Handbook** for the Trail Assessment Procedures and Guidelines, Alaska's Minimum State Mapping Standards and the (soon to be adopted) Interagency Trail Data Standards.

5. Trail Terminology

A major goal of this policy is to clarify and implement consistent terminology to provide for effective communication and common understanding. Terminology referenced in this policy has been obtained from many sources including the US Forest Service (in collaboration with the

National Park Service, the US Fish and Wildlife Service, and the Bureau of Land Management) and non-profit organizations such as Alaska Trails. It is the policy of the Division to utilize a standardized trail dictionary. Use of a standardized trail dictionary will allow management to become more uniform in the implementation of sustainable trail design practices and carry a common, consistent voice in the trails community.

See Section 6 of the **Alaska State Parks Trail Management Handbook** for a glossary of trail terms.

Alaska State Parks Trail Management Handbook

Complementary to this Policy, the Division has developed a reference guide that incorporates the necessary detail for implementation. This handbook will be an evolutionary publication that will start with the basics of pertinent trail guidelines and will grow over time with regular updates. The Handbook is intended to be used as a practical, hands-on tool to help improve trail management throughout the State.

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