



Sawatch College

Outdoor Studies Program

Backcountry Winter Travel Leadership Course

Backcountry Froelichers Team

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Backcountry Winter Travel Leadership Course

Winter 2019

Table of Contents

Introduction	4
1.0 Section 1- Statement of Work	5
2.0 Section 2 - Project Objectives	6
3.0 Section 5 - Project Deliverables	7
3.1 Daily Project Deliverables to be completed while on-site (12/10 - 12/5/2018)	7
3.2 Risk Management Planning	8
3.2.1 Overview of the Permit Terrain	8
3.2.2 Fieldwork Safety Plan	10
3.2.3 Ingress/Egress Travel Plan to/from the Sangree M. Froelicher Hut	14
3.2.4 Buckeye Gulch Run Atlas	17
3.2.4.1 Ski Terrain Maps and Photos	18
3.2.4.2 Climbing routes (skin track) and egress route	20
3.2.4.3 Stratified Runs	21
3.2.4.4 Closed Terrain	24
3.2.4.5 Run Names	24
3.2.4.6 Non-Explosive, Active Hazard Mitigation	25
3.2.5 Emergency Response Planning	25
3.2.5.1 General Emergency Response Operations and Evacuation Guidelines	25
3.2.5.2 Emergency Communications Guide	25
3.2.5.3 Important Weather and Avalanche Advisory Resources	26
3.2.5.4 Helicopter Landing Zones	26
3.2.5.5 Minimum Required Rescue Equipment	27
3.2.5.6 Suggested list of rescue equipment and supplies to be cached at the hut	27
3.3 Snow, Weather, and Avalanche Observations	28
3.3.1 Seasonal Snowpack and Weather Summary	28
3.3.2 Existing Remote, Telemetered Weather Stations in the Region	46
3.3.3 Weather and Snowpack Data Collection Scheme	46
3.3.3.1 Key Snowpack and Weather Study Plots	47
3.3.3.1.1 Snow Study Data List	49
3.3.3.1.2 Frequency Plan	49
3.3.3.2 Remote, Telemetered Weather Station	49
3.3.3.2.1 Weather Station Parameters	51
3.3.3.2.2 Weather Station Data Collection Frequency	52
3.3.3.2.3 Remote Station Data Transmission Plan	52
Summary Table for weather station details:	53

3.3.3.2.4 Stations Rough Cost Estimate	54
3.4 Forecasting	57
3.4.1 Permit Area Daily Forecast of Snow, Weather, and Avalanche Conditions	57
3.4.2 Identify Data Needed to Improve the Forecast During Each Operational Day	57
3.4.3 Daily Forecast Assessment	57
3.4.4 Forecast Zones	57
3.5 Communication	58
3.5.1 Pre-Course Orientation Video	58
3.5.1.1 Overview of the Buckeye Gulch area	59
3.5.1.2 Overview of basic safety practices while on course	59
3.5.1.3 Required Safety Equipment	59
3.5.1.4 Other key information for a course participant prior to going into the field	60
3.6 Project Presentation	60
4.0 Section 6- Timeline for Completion of Work	61

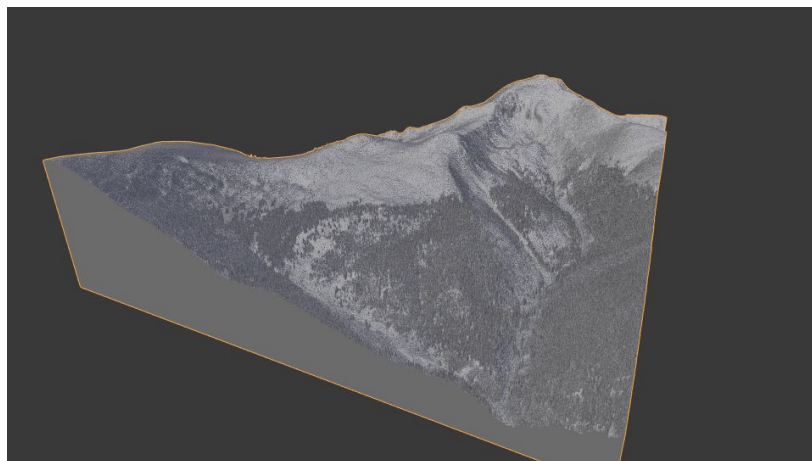
Introduction

Backcountry Froelichers is excited to respond to Sawatch College's Outdoor Studies Program's bid to be the adjunct faculty for the Backcountry Winter Travel Leadership Course (OUT 214). We are a team of experienced and capable avalanche and outdoor professionals, who are passionate about educating our next generation of outdoor leaders. We recognize the inherent risks involved in outdoor education and have developed a comprehensive plan that promotes student learning while maintaining an overall conservative approach. Our proposal is comprised of a dynamic student curriculum framed by an appropriate and thorough risk management plan, snowpack, weather, and avalanche observations plan, forecasting plan, a land use permit management system, and promotional marketing. We would be honored to partner with Sawatch College and help develop our future outdoor leaders.

OUT 214 Summary:

The primary goal of the Sawatch College Outdoor Studies Program is to develop skilled outdoor leaders. The OSP offers a 2-year Associate's Degree in Outdoor Recreation Leadership that prepares its students to enter the outdoor industry with a broad foundation of academic coursework and outdoor skills and leadership training. Included in the OSP is the Backcountry Winter Travel Leadership Course (OUT 214), which develops students' wintertime backcountry travel and basic avalanche safety skills and knowledge. The course runs from January to April during the winter semester, and includes up to five week-long courses with two instructors and twelve students.

The Backcountry Winter Travel Leadership Course is held in Buckeye Gulch in the Northern Sawatch mountains, which is north of Leadville, Colorado. Sawatch College holds a priority use permit from the USFS Leadville Ranger District to conduct wintertime educational programming. Additionally, the college has educational access to the Sangree M. Froelicher Hut and the Alpine Resource Center, which are located in the Buckeye Gulch area. The hut will provide student housing and classroom space.



1.0 Section 1- Statement of Work

1.1 Sawatch College Outdoor Studies Program is seeking a detailed analysis of permitted terrain and risk management activities to be used for wintertime backcountry travel courses for the 2019 winter season beginning January 2019. These courses will be led by qualified instructors who are appropriately credentialed college educators with demonstrable expertise in backcountry winter travel and avalanche safety education.

2.0 Section 2 - Project Objectives

2.1 To provide the college with a working template for conducting wintertime backcountry courses during the 2018/19 season and into the future in the Buckeye Gulch permit area.

2.2 Identify appropriate terrain for conducting OUT214 coursework.

2.3 Identify an appropriate location(s) to install a remote sensing weather station(s).

2.4 Provide a comprehensive operational risk management plan to be used by instructors while preparing for and leading OUT 214 courses.

2.5 Provide detailed information that qualified course instructors will need prior to conducting OUT 214 courses in this zone.

3.0 Section 5 - Project Deliverables

3.1 Daily Project Deliverables to be completed while on-site (12/10 - 12/5/2018)

3.1.1 Respondents must demonstrate daily operational risk management practices as outlined in the supplemental document *“Project Scoring- Daily Categories”*

3.1.2 Respondents must engage in daily forecasting activities as outlined in the supplemental document *“Project Scoring- Daily Categories”* and Section 3.4 below.

3.2 Risk Management Planning

3.2.1 Overview of the Permit Terrain

Provide a brief, less than one page, overview of the permitted terrain (i.e. key land features, weather, snowpack, avalanche hazard zones).

The Buckeye Gulch Permit Zone is located in the San Isabel National Forest and is managed by the Leadville Ranger District. It is northeast of Leadville, on the north side of CO 91. The permit zone is accessed via the Buckeye Gulch Trailhead. The trailhead parking lot is about 4.5 miles northeast of the junction of Highways 24 and 91 in Leadville.

The Buckeye Gulch Permit Zone includes all of the mountains that are accessible via the Buckeye Gulch Trailhead (10,180 ft). The zone is comprised of three main sections, roughly looking like a Y. The first, short section is the entrance gulch leading to the junction between Buckeye Gulch proper and a smaller, unnamed side gulch. The zone only includes the mountain slopes that drain into the East Fork of the Arkansas River. (The slopes draining away are not included in the permit area).

The terrain in the first section, from the parking lot to the junction, begins as a fairly narrow gully with thick trees. About one mile in, at the junction, the gulch splits into two branches. The northern branch is the Buckeye Gulch proper, and Forest Service Road 137 runs up it for .8 miles. This branch heads north and gradually dog-legs to the northwest, eventually culminating in the summit of Buckeye Peak (12,867 ft). The western branch heads west into an unnamed side gulch, and Forest Service Road 137A runs along it for .5 miles. This branch heads west into a basin between Mt. Zion and peak 12,254'. This split in the gulch naturally delineates a significant difference in avalanche hazard exposure.

Heading up the northern branch, the eastern flank (generally west facing) offers low angle and wooded terrain that is suitable for travel. The lower portion of the western flank (east facing) has an average slope angle of 22 degrees, and a number of slopes hit above 35 degrees. Most of the upper portion of the western flank is permanently closed on our run list; the northern branch ends in a basin above Buckeye Lake that is flanked on the west by terrain consistently exceeding 35 degrees, even hitting over 50 degrees in the SE facing couloirs below the peak.

The western branch, on the other hand, is predominantly low angle and offers the easiest access to the Sangree M. Froelicher Hut. It only has isolated slopes that hit 35 degrees or higher, which are quite easy to avoid. Overall the northern branch offers terrain that can be complicated to navigate under certain avalanche conditions, and the western branch offers simpler terrain that is easier and safer to navigate.

The Sangree M. Froelicher Hut (11,650 ft) sits where the basins of the northern branch and the western branch meet, near tree line, below unnamed peak 12,254'. The location allows for a variety of terrain options even when the snowpack, weather, and avalanche conditions are

challenging, including easy access to below tree line terrain from the hut that exceed 35 degrees.

In the permit area, the weather is typical of the Sawatch zone. Winds generally come from the west, and cornices are predominantly found above treeline on NE-E-SE facing features. The W-SW-S aspects tend to hold less snow; below treeline, this poses the hazard of a thin snowpack like hiding fallen trees. The snowpack is fairly representative of that of the Sawatch: low HS, widespread facets, and most often featuring a strong over weak persistent layer somewhere on N-NE-E-SE aspects on average. The permit area is an ideal venue to teach outdoor education.

3.2.2 Fieldwork Safety Plan

Provide a simple general course safety plan outline for use by instructors and college fieldwork monitors (e.g. a simple fieldwork safety plan for day to day operations. See example provided).

3.2.2.1 Provide a simple communications plan for daily coursework for use by course instructors.

3.2.2.2 Provide a minimum instructor and student equipment list for daily coursework operations.

Sawatch College Outdoor Studies Program Backcountry Winter travel Leadership Course OUT 214 Fieldwork Safety Plan

Location:

Dates:

Instructors: *[List instructor names]*

Overview:

[Provide brief summary of the objective]

General Itinerary:

[Enter itinerary]

EX:

Day 1

Day 2

Day 3

Communication:

Each instructor carries a cell phone, and each group has at least one inReach and two radios. We use radio frequency FRS Channel 14.

Each group checks in and out of the field at the beginning and end of each course with the Course Monitor, who is the point of contact at the college, by using their cell phone or inReach. Instructors check in two times a day during the course--at 11am and 3pm, or otherwise determined by the instructor and Course Monitor.

Cellular coverage: cell phones work near the Sangree M. Froelicher hut and in most areas in the Buckeye Gulch. Coverage is spotty as one nears the drainage and in certain areas downslope from the ridgelines.

Nearest phones are at private residences near the trailhead and off of Route 91. The nearest commercial businesses are High Country Snowmobile Tours .3 miles east of the trailhead off of Route 91, and Custom Edge Woodworking one mile to the west of the trailhead off of Route 91. (White Mountain Snowmobile Tours is 2.3 miles east of the trailhead.)

Weather and Avalanche Advisory Information:

We use the following resources:

Colorado Avalanche Information Center—Sawatch Zone

NWS Point Forecast

Weather Stations:

- Mt. Zion
- Fremont
- Leadville

Field Venue:

Buckeye Gulch Zone

Access to the Buckeye Gulch zone is from the Sangree M. Froelicher Hut trailhead off of Route 91. Trailhead address is 300 Buckeye Creek Road, Leadville.

The Buckeye Gulch Run List provides run lists for the area.

Emergency Contact Info:

[List instructor name, cell phone number, and emergency contact name, relationship, and phone number]

Backcountry Froelichers Main Emergency Contacts

Zach Wade 970-389-2890

Gabi Benel 917-848-2824

Sawatch College Outdoor Studies Program Emergency Contacts

[Enter name(s) and phone number(s)]

Emergency Information:

911 for all life-threatening emergencies

Lake County Sheriff's Department 719-486-1249

Closest Hospital:

St. Vincent Hospital

822 W 4th St,

Leadville, CO 80461

719-486-0230

Evacuation Plan:

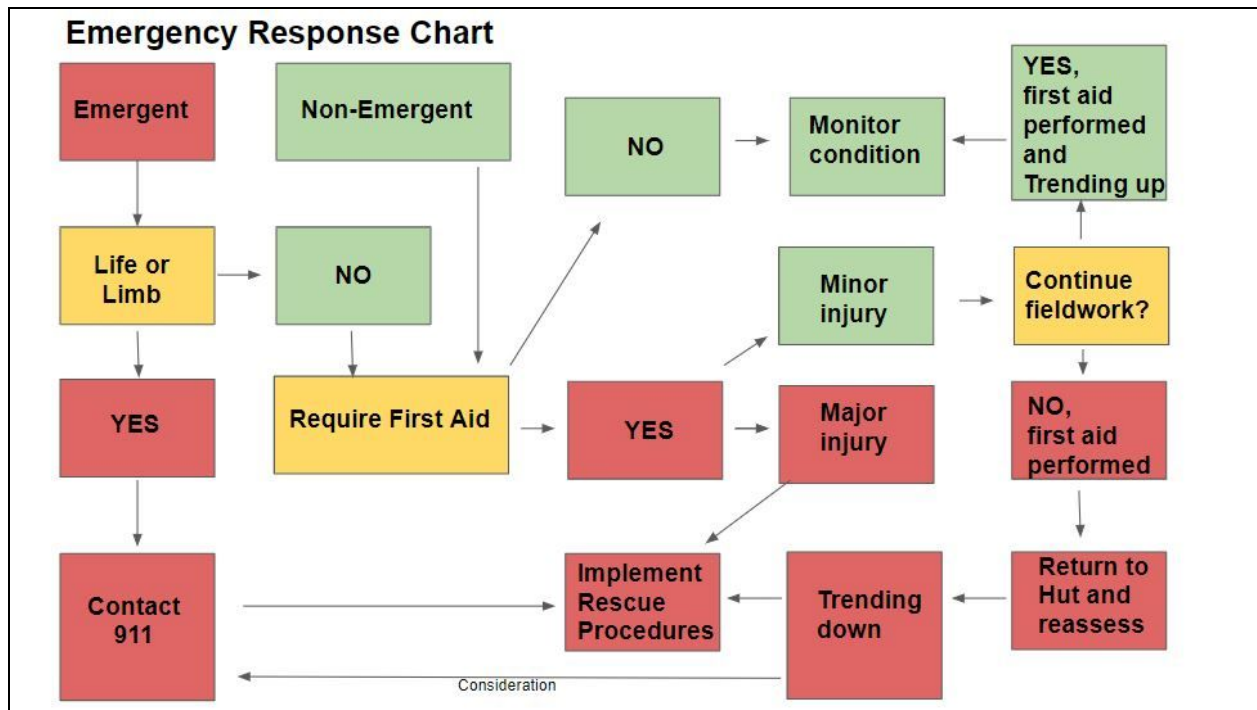
All groups will ideally self-evacuate to the trailhead.

Minor, non-debilitating injuries will be evaluated and, if necessary, evacuated to the trailhead.

A vehicle is left at the trailhead during the entire course.

If not life or limb injury, but more than minor, request snowmobile team from SAR.

Serious, life threatening injuries will be transported to an air evacuation site, if possible.
 Transport to the trailhead if air evacuation is not possible.
 Outside resources include the Lake County Search and Rescue.



Helicopter Landing Zones:

See the Run Atlas for a visual of established helicopter landing zones.

Buckeye Gulch LZ1

- UTM 13S 0392241E 4353133N
- Elevation: 10,900'
- Located in West Buckeye drainage in between Zone 2 and Zone 3 at the bottom of Sangree's Chute

Buckeye Gulch LZ2

- UTM 13S 0391060E 4352595N
- Elevation: 11,500'
- Located on the southernmost ridge of Zone 2 above Tango Trees

Buckeye Gulch LZ3

- UTM 13S 0391624E 4353778N
- Elevation: 11,700'
- Located just west of the hut in Zone 3 in Green Dream

Buckeye Gulch LZ4

- UTM 13S 0393373E 4354583N
- Elevation: 12,000'
- Located on the eastern ridge of Zone 5 above One Eyed Willy

Required Gear:

Instructors and students will carry items on the individual gear list (see list below). In addition, each group will carry: VHF radio, rescue sled, ski rope/cordelette, guide tarp, first aid kit, repair kit, GPS enabled device, charged cell phone, backup cell phone battery, maps, and extra avalanche beacon and batteries and an inReach communication device.

Individual Gear List:

Required items:

- Backcountry skis or splitboard
- Boots
- Poles
- Climbing skins
- Ski wax, skin wax, waxing tools
- Crampons/ski crampons
- Pack
- Avalanche transceiver
- Snow shovel
- Probe
- Water bottles or hydration system
- Notebook and pen or pencil
- Slope meter or compass inclinometer
- Snow Pit Analysis kit
- Altimeter or altimeter watch
- Whistle/signaling mirror
- Route description, guidebook, or copy of Buckeye Gulch Run Atlas
- Map
- Compass
- GPS/GPS enabled phone and extra batteries
- Sunglasses
- Goggles
- Headlamp and extra batteries
- First-aid kit
- Fire starter, matches or lighter
- Repair kit
- Knife or multi-tool

Personal Items:

- Lip balm
- Sunscreen
- Toilet paper
- Sanitation trowel and/or WAG Bags
- Hand sanitizer

Clothing:

- Wicking base layers (synthetic or wool)
- Fleece jacket or vest (insulating mid layer)
- Fleece pants
- Insulating jacket (down or poly-fill)
- Waterproof/breathable jacket (or soft shell)
- Waterproof/breathable pants or bibs (or soft shell)
- Insulating hat, cap, balaclava or headband
- Bandana or Buff (neck or face gaiter)
- Sun-shielding cap or hat
- Gloves, mittens and/or overmittens
- Light gloves (for high-energy activity)
- Socks (synthetic or wool)

Optional:

- Vacuum bottle
- Handwarmer/footwarmer packets
- Camera
- Binoculars
- Two-way radios
- Helmet
- Personal locator beacon
- Cell phone or satellite messenger
- Credit card/cash/photo ID
- Music player with headphones
- Extra snacks
- Towel and post-activity change of clothing

3.2.3 Ingress/Egress Travel Plan to/from the Sangree M. Froelicher Hut

Include parking information and address any private property considerations at the trailhead.

The parking lot for the Sangree M. Froelicher Hut is located off a short access road on the side of Route 91, and has capacity for multiple vehicles. It will accommodate the vans used by the college. The address to the turn off is 300 Buckeye Creek Road, Leadville.



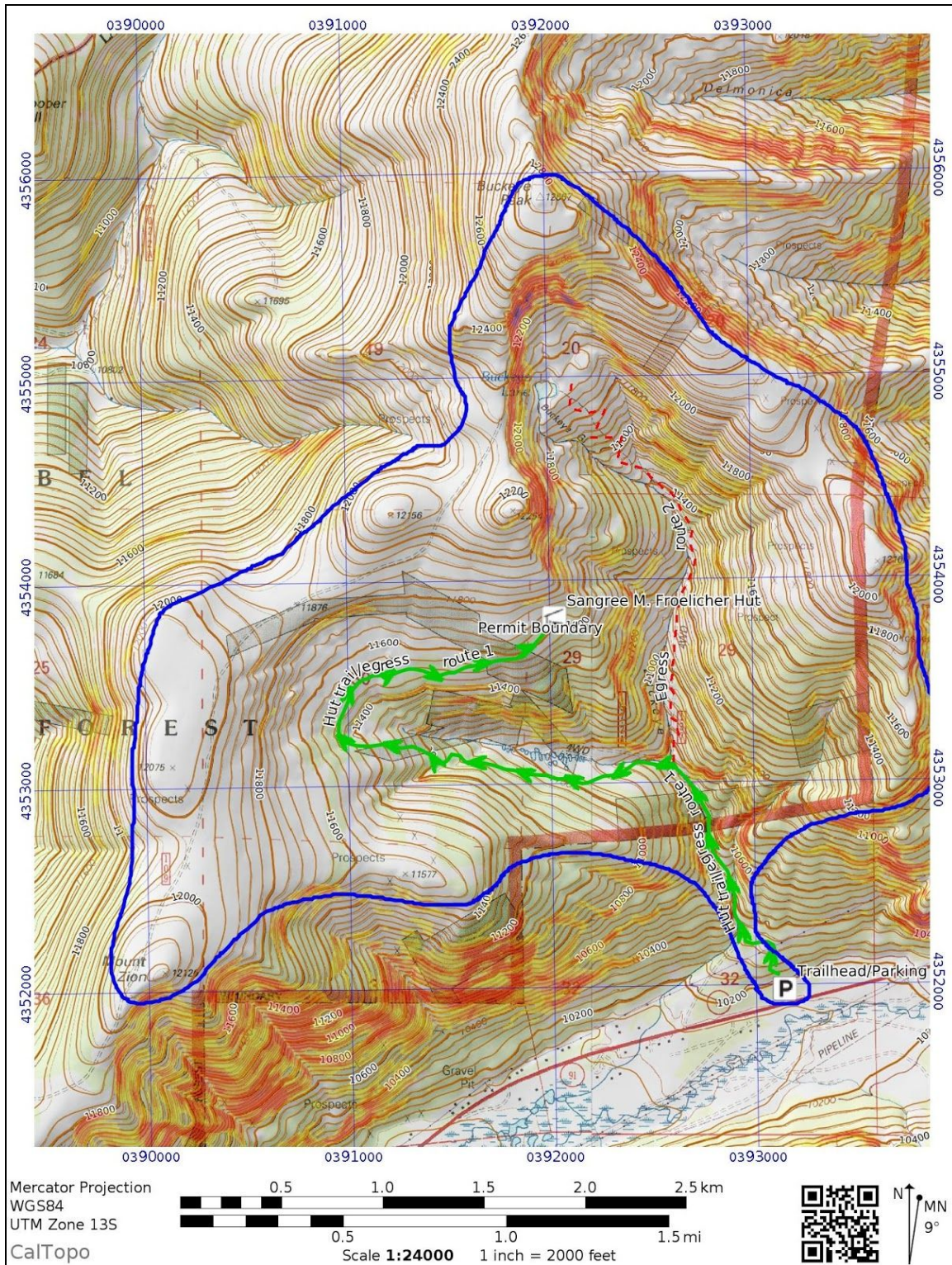
The route to the hut is accessed directly from the parking lot and is signed well with standard Tenth Mountain Division Hut System trail markers.



The designated trail to and from the hut is marked to route travelers in a permissible way through public and private lands.



In the Atlas below, the green line with arrows marks the standard route into and out of the hut.
 The blue line marks the permit area perimeter.



The satellite image below has the standard ingress/egress route marked in green and the egress route from the Buckeye Bowl marked in red.



A virtual tour video of the route into the hut can be watched here:

<https://vimeo.com/310999619>

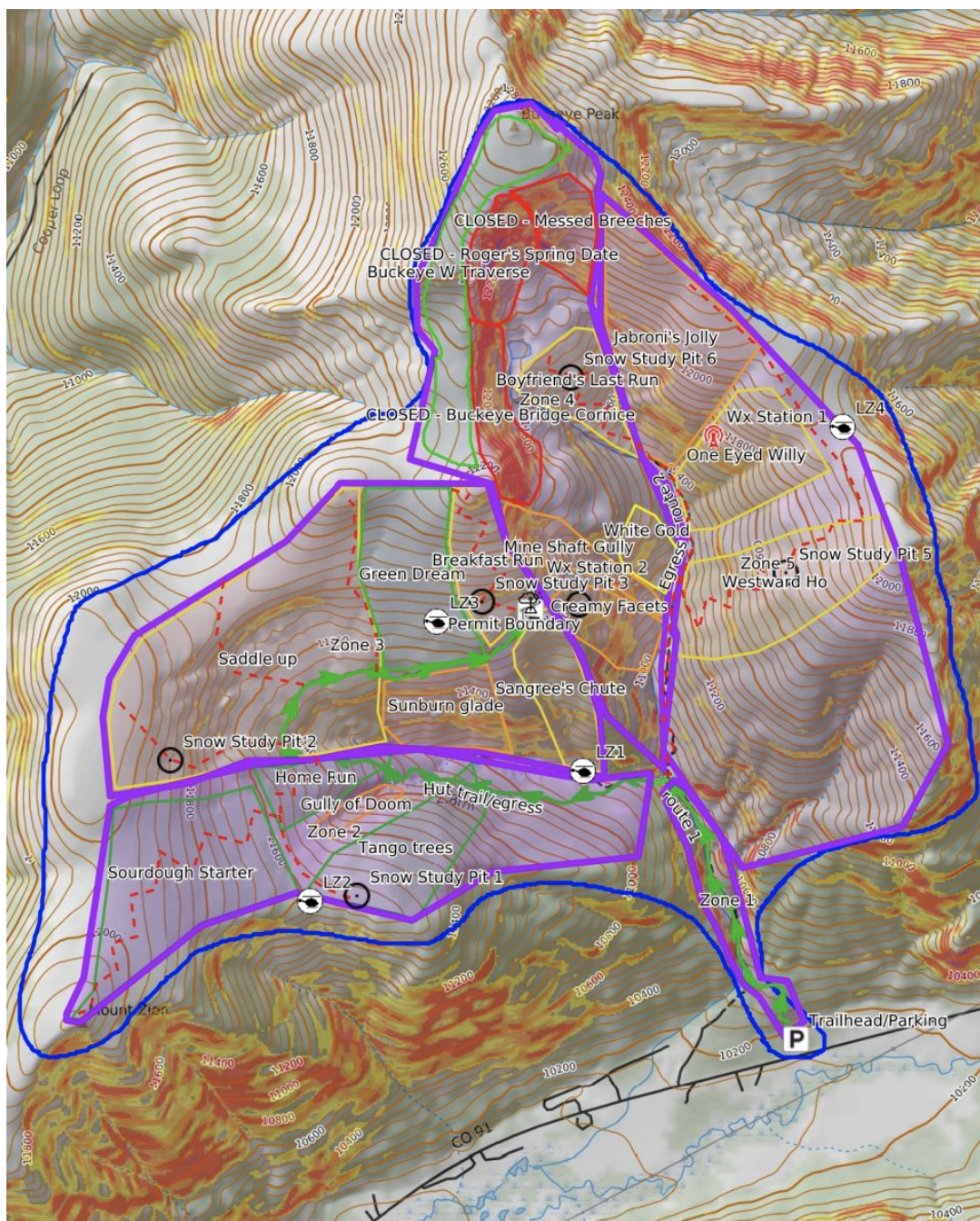
There are several forks in the access route to the hut. While these are well marked, group leaders will need to monitor these forks to ensure participants do not leave the route. The primary intersection to monitor is the Route 137 / Route 137A split, where the green and red lines meet in the image above. This intersection is seen in the photo below as well:



3.2.4 Buckeye Gulch Run Atlas

<https://caltopo.com/m/QBG9>

The Caltopo Buckeye Gulch Run Atlas is an interactive map with the option to hide or show multiple layers. Layers include run names/areas, forecast zones, hut route, landing zones, snow study pits, up-tracks, and weather station.



An orientation to the area and atlas can also be seen in this flyover video:

<https://vimeo.com/310998964>

3.2.4.1 Ski Terrain Maps and Photos

Provide annotated map/s and terrain photographs of ski terrain for a variety of conditions that will facilitate OUT 214 learning objectives.

We have chosen terrain to accommodate a wide range of skier/rider abilities, with the potential to expose students to all aspects/elevations and varying degrees of avalanche terrain if conditions permit. Close to the hut there are “Green” and “Yellow” areas that provide great terrain for skin-track setting practice and avalanche rescue training/practice.

A bank of terrain photos, sorted into each forecast zone by run name, are accessible in the Backcountry Froelichers Google Drive. An example terrain photo exists below.

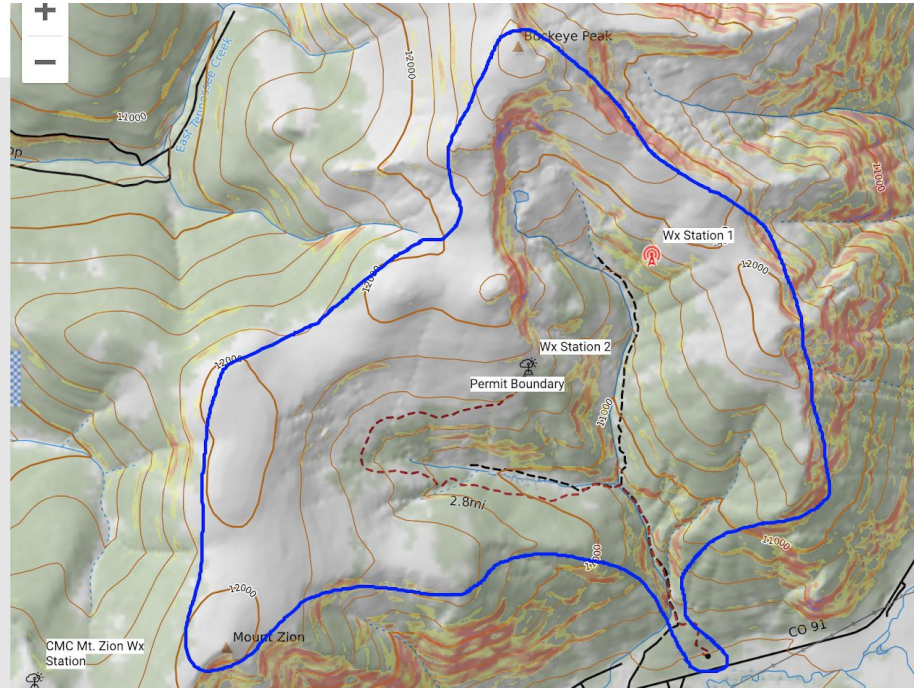


Terrain Photo of “Creamy Facets”, “Mine Shaft Gully” and “White Gold” (left to right)

The images below are a series of annotated maps including the weather stations, landing zones, and snow study plots.

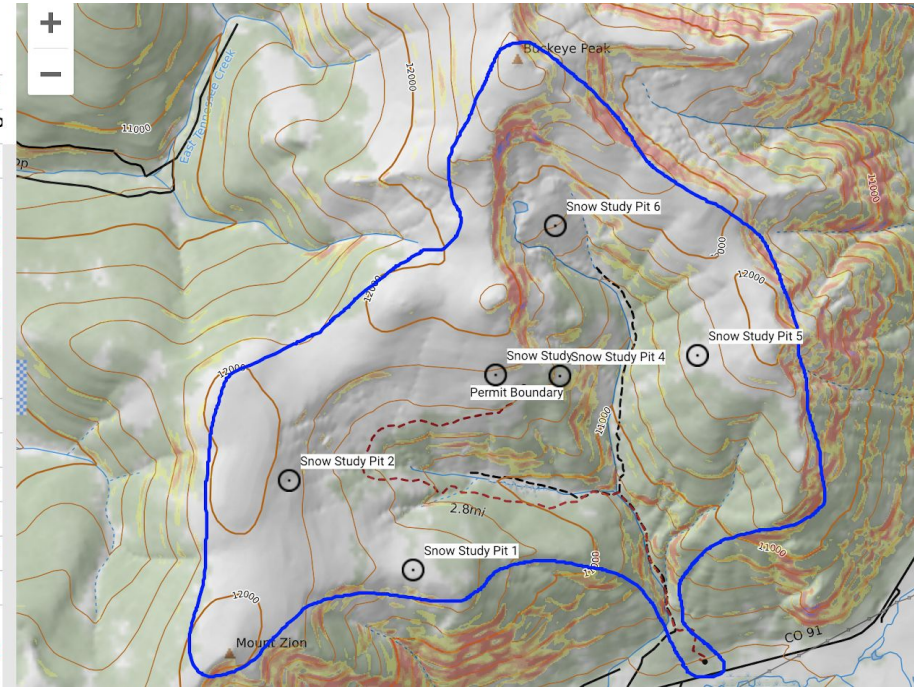
Weather Stations:

- MapBuilder Topo
 - 7.5' Topo Maps
 - Forest Service
 - Aerial Topo Hybrid
 - Hybrid Satellite
 - Slope Angle Shading
- Forecast Zones
 - Hut Route and Egress Routes
 - Landing Zones
 - Snow Study Pits
 - Uptracks
 - Wx Stations
 - Zone 2 Runs
 - Zone 3 Runs
 - Zone 4 Runs
 - Zone 5 Runs
 - Lines & Polygons
- CMC Mt. Zion Wx Sta
 - Wx Station 1
 - Wx Station 2
 - Bulk Ops
 - Permit Boundary
 - Bulk Ops



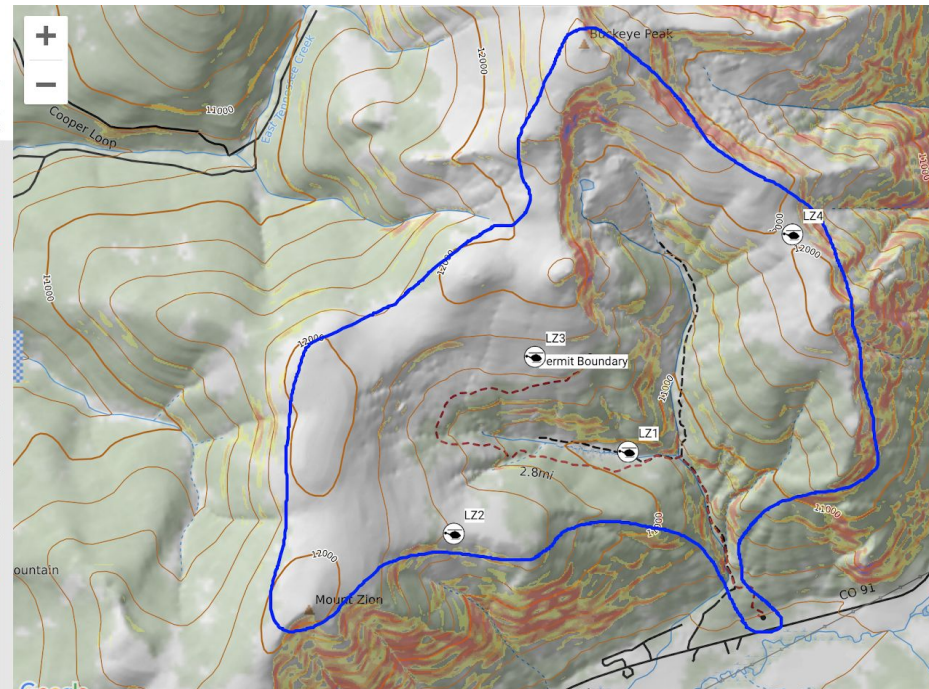
Snow Study Plots:

- Aerial Topo Hybrid
 - Hybrid Satellite
 - Slope Angle Shading
- Forecast Zones
 - Hut Route and Egress Routes
 - Landing Zones
 - Snow Study Pits
 - Uptracks
 - Wx Stations
 - Zone 2 Runs
 - Zone 3 Runs
 - Zone 4 Runs
 - Zone 5 Runs
 - Lines & Polygons
- Snow Study Pit 1
 - Snow Study Pit 2
 - Snow Study Pit 3
 - Snow Study Pit 4
 - Snow Study Pit 5
 - Snow Study Pit 6
 - Bulk Ops
 - Permit Boundary
 - Bulk Ops



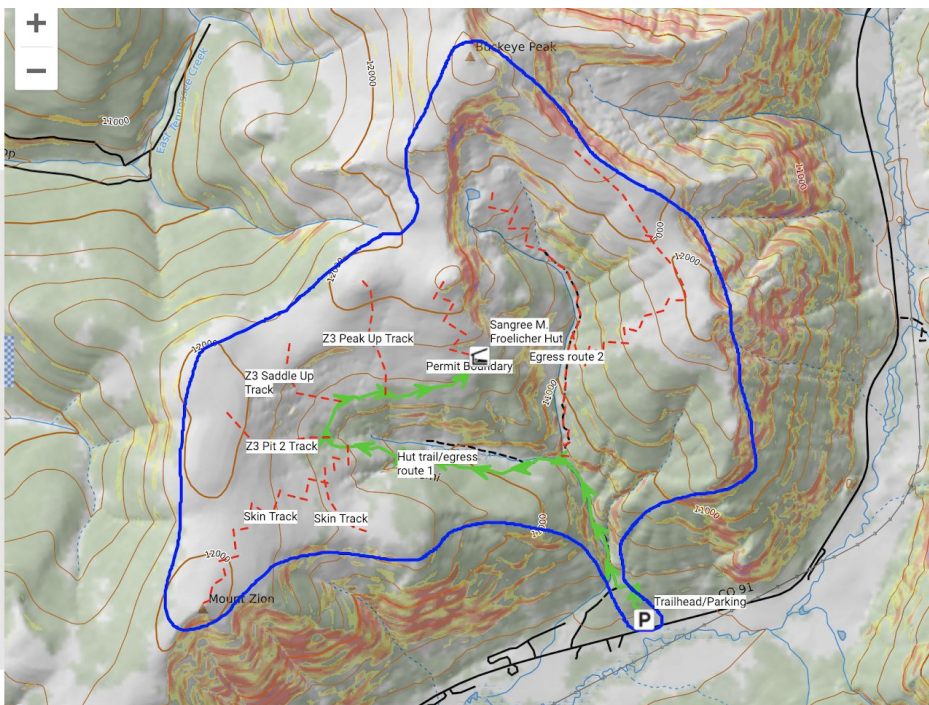
Landing Zones:

- Aerial Topo Hybrid
- Hybrid Satellite
- Slope Angle Shading
- Forecast Zones
- Hut Route and Egress Ro
- Landing Zones
 - LZ1
 - LZ2
 - LZ3
 - LZ4
- Snow Study Pits
- Uptracks
- Wx Stations
- Zone 2 Runs
- Zone 3 Runs
- Zone 4 Runs
- Zone 5 Runs
- Lines & Polygons
 - Permit Boundary
- + Add New Object
- + Add New Layer



3.2.4.2 Climbing routes (skin track) and egress route

- Hut Route and Egress Ro
 - Egress route 2
 - Hut trail/egress route
 - Sangree M. Froelicher
 - Trailhead/Parking
- Landing Zones
- Snow Study Pits
- Uptracks
 - N/A
 - N/A
 - N/A
 - Skin Track
 - Skin Track
 - Z3 Peak Up Track
 - Z3 Pit 2 Track
 - Z3 Saddle Up Track
- Wx Stations
- Zone 2 Runs
- Zone 3 Runs
- Zone 4 Runs
- Zone 5 Runs
- Lines & Polygons
 - Permit Boundary



3.2.4.3 Stratified Runs

Stratify ski runs by steepness, avalanche hazard, and other considerations, include critical indicators for opening / closing terrain (e.g. Green, Yellow, Red ratings relating to avalanche potential, steepness, consequence, etc.).

The terrain within the permitted area has been divided into five forecast zones. Within the forecast zones, we have separated terrain into ski runs. Ski runs are delineated by terrain barriers and changes in terrain hazards. Each run has an associated color, which indicates the run steepness and avalanche hazard due to terrain considerations.

Run Color	Green	Yellow	Orange	Red
Avalanche Terrain Exposure Scale (ATES) rating	'Simple terrain' We classify this as Non Avalanche terrain '	'Simple and Challenging terrain' We classify this terrain as Avalanche terrain	'Challenging terrain' We classify this terrain as Avalanche terrain	'Complex terrain' We classify this terrain as Permanently Closed Terrain
Slope Angle	All terrain less than 27°	-Mostly less than 30° -Isolated areas of 30°-34° -No terrain is 35° or steeper. -Steeper terrain with an increase in avalanche hazard may exist above this terrain.	-Significantly larger portion of terrain between 30°-35° -Isolated areas of terrain 35° and above.	-Greater than 46° -Large percentage of terrain equal to and above 35°.
Critical indicators for opening / closing terrain	There is no avalanche danger in this terrain and there is no overhead avalanche hazard existing above this terrain. Green terrain remains permanently open with regards to avalanche hazard.	Yellow terrain will be entered pending on the instructors assessment. -Critical indicators that automatically close Yellow terrain for that day: - CAIC Sawatch forecast of 'Considerable' or higher danger for that day	Orange terrain will be entered pending on the instructors assessment. -Critical indicators that automatically close Orange terrain for that day: - CAIC Sawatch forecast of 'Moderate' or higher danger for that day and the	Red terrain is permanently closed and will not be entered under any conditions. This terrain produces a large cornice, contains multiple cliffs and includes multiple avalanche paths.

		<p>and the previous 3 days. (Danger ratings will be messaged via inReach to the instructor daily)</p> <ul style="list-style-type: none"> - Recent avalanches (<3 days old) in similar yellow terrain (Aspect/Elevation). 	<p>previous 3 days. (Danger ratings will be messaged via inReach to the instructor daily)</p> <ul style="list-style-type: none"> - Recent avalanches (<3 days old) in similar terrain (Aspect/Elevation). - Whenever a PSa or DPSa problem exists within the terrain characteristics (Aspect/Elevation) of the Orange terrain in question. 	
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Appendix 3.2.4.3

THE AVALANCHE TERRAIN EXPOSURE SCALE

Grant Statham^{1*}, Bruce McMahon¹, Ian Tomm² 1 Parks Canada Agency (PCA), 2 Canadian Avalanche Association (CAA)

5. AVALANCHE TERRAIN EXPOSURE SCALE (ATES)

Figure 1: ATES Public Communication Model (v.1/04)

Description	Class	Terrain Criteria
Simple	1	Exposure to low angle or primarily forested terrain. Some forest openings may involve the runout zones of infrequent avalanches. Many options to reduce or eliminate exposure. No glacier travel.
Challenging	2	Exposure to well defined avalanche paths, starting zones or terrain traps; options exist to reduce or eliminate exposure with careful routefinding. Glacier travel is straightforward but crevasse hazards may exist.
Complex	3	Exposure to multiple overlapping avalanche paths or large expanses of steep, open terrain; multiple avalanche starting zones and terrain traps below; minimal options to reduce exposure. Complicated glacier travel with extensive crevasse bands or icefalls.

Figure 2: ATES Technical Model (v.1/04)

	1 – Simple	2 - Challenging	3 - Complex
Slope angle	Angles generally < 30°	Mostly low angle, isolated slopes >35°	Variable with large % >35°
Slope shape	Uniform	Some convexities	Convoluted
Forest density	Primarily treed with some forest openings	Mixed trees and open terrain	Large expanses of open terrain. Isolated tree bands
Terrain traps	Minimal, some creek slopes or cutbanks	Some depressions, gullies and/or overhead avalanche terrain	Many depressions, gullies, cliffs, hidden slopes above gullies, cornices
Avalanche frequency (events:years)	1:30 ≥ size 2	1:1 for < size 2 1:3 for ≥ size 2	1:1 < size 3 1:1 ≥ size 3
Start zone density	Limited open terrain	Some open terrain. Isolated avalanche paths leading to valley bottom	Large expanses of open terrain. Multiple avalanche paths leading to valley bottom
Runout zone characteristics	Solitary, well defined areas, smooth transitions, spread deposits	Abrupt transitions or depressions with deep deposits	Multiple converging runout zones, confined deposition area, steep tracks overhead
Interaction with avalanche paths	Runout zones only	Single path or paths with separation	Numerous and overlapping paths
Route options	Numerous, terrain allows multiple choices	A selection of choices of varying exposure, options to avoid avalanche paths	Limited chances to reduce exposure, avoidance not possible
Exposure time	None, or limited exposure crossing runouts only	Isolated exposure to start zones and tracks	Frequent exposure to start zones and tracks
Glaciation	None	Generally smooth with isolated bands of crevasses	Broken or steep sections of crevasses, icefalls or serac exposure

<http://arc.lib.montana.edu/snow-science/objects/issw-2006-491-497.pdf>

3.2.4.4 Closed Terrain

Terrain/Areas that will not be used due to safety considerations (indicated permanently closed terrain).

Permanently Closed terrain is indicated on the Caltopo Buckeye Gulch Run Atlas with the run color red. The three closed sections are named “Buckeye Bridge Cornice”, “Roger's Spring Date” and “Messed Breeches”. All of this terrain exists in Zone 4 which lies NE of the hut encompassing terrain 35 degrees and greater, large cornice formations, and multiple cliffs and avalanche paths.

“Roger's Spring Date” and “Messed Breeches”(left) “Buckeye bridge cornice” (right)



3.2.4.5 Run Names

Green (Forecast zone #)	Yellow (Forecast zone #)	Orange (Forecast zone #)	Red (Forecast zone #)
Home Run (2)	Breakfast Run (3)	Gully of Doom (2)	Buckeye Bridge Cornice (4)
Sourdough Starter (2)	Sangree's Chute (3)	Sunburn glade (3)	Roger's Spring Date (4)
Tango Trees (2)	Saddle up (3)	Creamy Facets (4)	Messed Breeches (4)
Green Dream (3)	White Gold (4)	Mine Shaft gully (4)	
Buckeye W Traverse (4)	Boyfriend's Last Run (4)	Jabroni's Jolly (5)	
	One Eyed Willy (5)		
	Westward Ho (5)		

3.2.4.6 Non-Explosive, Active Hazard Mitigation

Considerations for non-explosive, active avalanche hazard mitigation practices and under what circumstances they may be implemented.

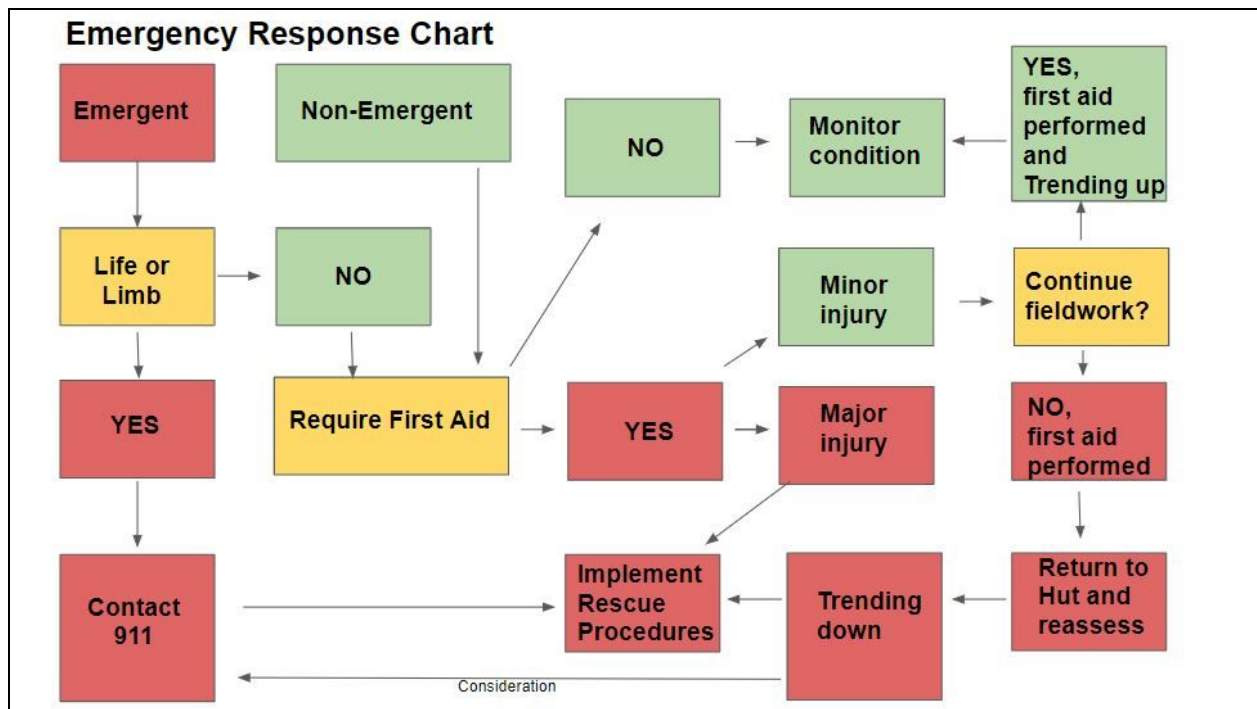
Overall our mitigation strategy is to leave the zone wild and not control any slopes. We will manage the terrain by only skiing or traveling on or near slopes that we deem safe. We feel this to be appropriate for a backcountry course setting, as that is how students will encounter the backcountry after the course - uncontrolled. The following list addresses the few exceptions in which we may consider minor mitigation:

- *Slope cut any small slopes surrounding skin tracks given avalanche hazard.*
- *Consider ski cutting open runs below hut for greater opportunity to keep open and use in course.*

3.2.5 Emergency Response Planning

3.2.5.1 General Emergency Response Operations and Evacuation Guidelines

- See information below for emergency contact information, available rescue gear, and potential helicopter landing zones



3.2.5.2 Emergency Communications Guide

Guide includes radio frequencies, key emergency contact numbers, and key local emergency resources (e.g. local and regional hospitals)

- 911 for all life-threatening emergencies
 - Backcountry Froelichers Emergency Line
 - 970-389-2890 (Zach Wade's cell)
 - Lake County Dispatch and Sheriff's Office
 - 719-486-1249 (Non-emergency)
 - St. Vincent Hospital - Leadville
 - 719-486-0230 (Non-emergency)
 - Hospital address 822 W 4th St, Leadville, CO 80461
 - Lake County SAR
 - 719-486-3333 (Non-emergency)
 - InReach emergency protocol
-

3.2.5.3 Important Weather and Avalanche Advisory Resources

- Colorado Avalanche Information Center—Sawatch Zone
 - Avalanche information
 - Weather information
 - Weather Stations:
 - Mt. Zion
 - Fremont
 - Leadville
 - NWS Point Forecast
 - See 3.2.2.2 for full fieldwork safety plan
-

3.2.5.4 Helicopter Landing Zones

Identify potential helicopter landing zones appropriate for emergency air evacuation.

- See run atlas for a visual of identified helicopter landing zones
- Buckeye Gulch LZ1 UTM 13S 0392241E 4353133N
 - Elevation: 10,900'
 - Located in West Buckeye drainage in between Zone 2 and Zone 3 at the bottom of Sangree's Chute
- Buckeye Gulch LZ2 UTM 13S 0391060E 4352595N
 - Elevation: 11,500'
 - Located on the Southernmost ridge of Zone 2 above Tango Trees
- Buckeye Gulch LZ3 UTM 13S 0391624E 4353778N
 - Elevation: 11,700'
 - Located just west of the hut in Zone 3 in Green Dream

- Buckeye Gulch LZ4 UTM 13S 0393373E 4354583N
 - Elevation: 12,000'
 - Located on the Eastern ridge of Zone 5 above One Eyed Willy
-

3.2.5.5 Minimum Required Rescue Equipment

List of minimum required rescue equipment for course instructors and students during course fieldwork

- Beacon, probe, and shovel
 - VHF radio
 - rescue sled
 - ski rope/cordelette
 - guide tarp
 - first aid kit
 - repair kit
 - GPS enabled device
 - charged cell phone
 - backup battery or charging device
 - Maps
 - extra avalanche beacon and batteries
 - inReach communication device
 - See section 3.2.2.2 for full gear list
-

3.2.5.6 Suggested list of rescue equipment and supplies to be cached at the hut

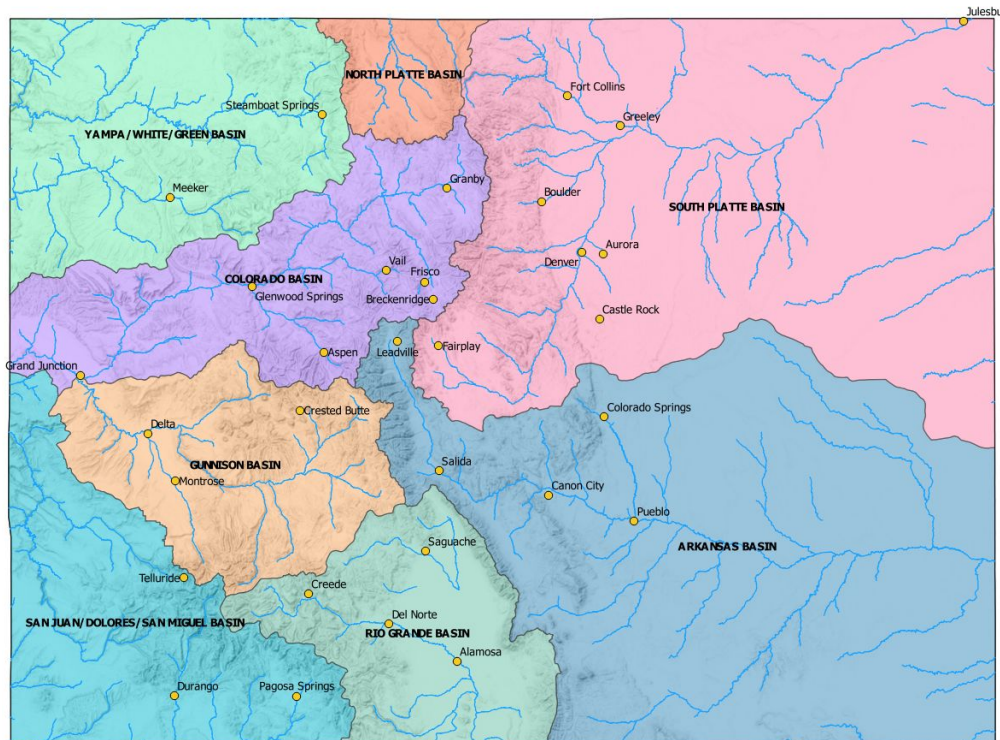
- Full size rescue sled
 - High alpine rescue gear
 - First aid kit
 - Hypothermia bag
 - Extra skis, board, climbing skins, and ski poles
 - Shovels
 - Probes
 - Batteries
 - Candles
 - Flares
 - Toolkit
 - Extra clothing, mittens/gloves
-

3.3 Snow, Weather, and Avalanche Observations

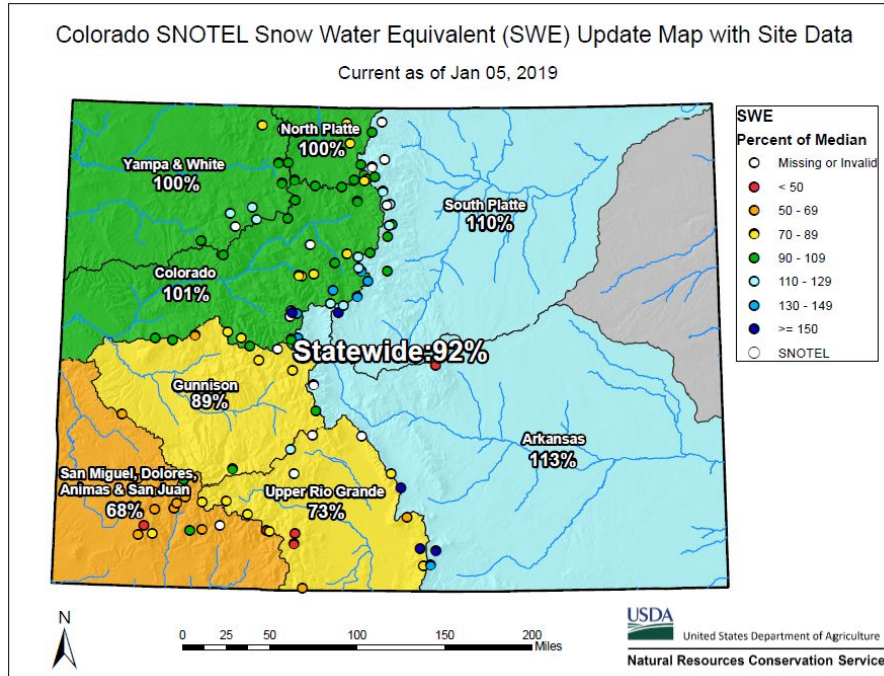
3.3.1 Seasonal Snowpack and Weather Summary

Below are images and charts that show the current state of the snowpack both in the region of the hut and the state of Colorado through January 5, 2019.

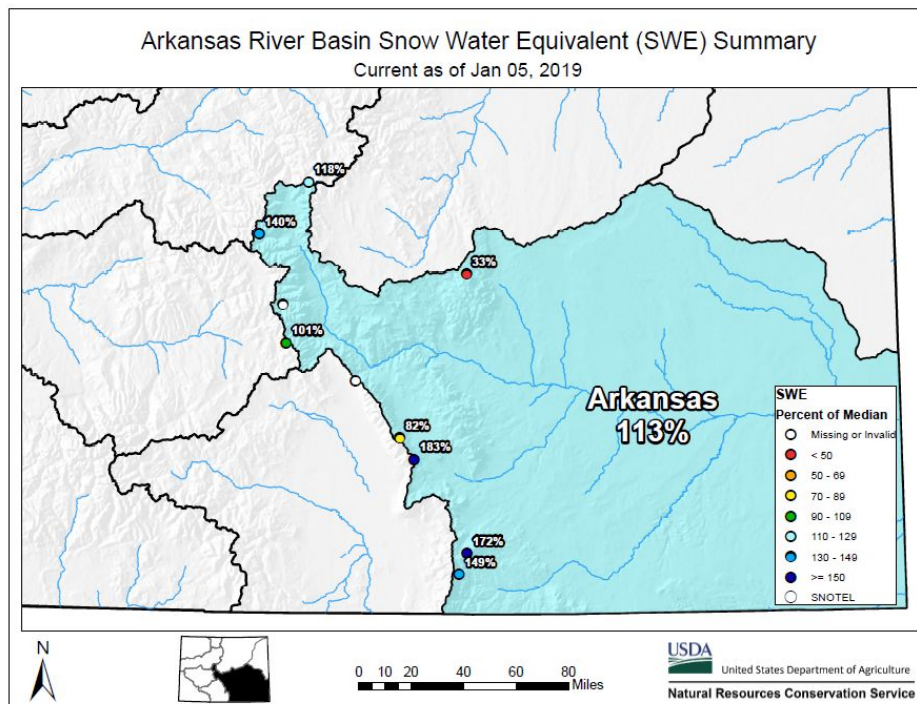
The image below shows an overview of the geography of the State of Colorado. The hut is located just north of Leadville in the Arkansas Basin, and is close to the border of the Colorado and South Platte Basins.



Statewide, the snow water equivalent (SWE) is at 92% of the median.

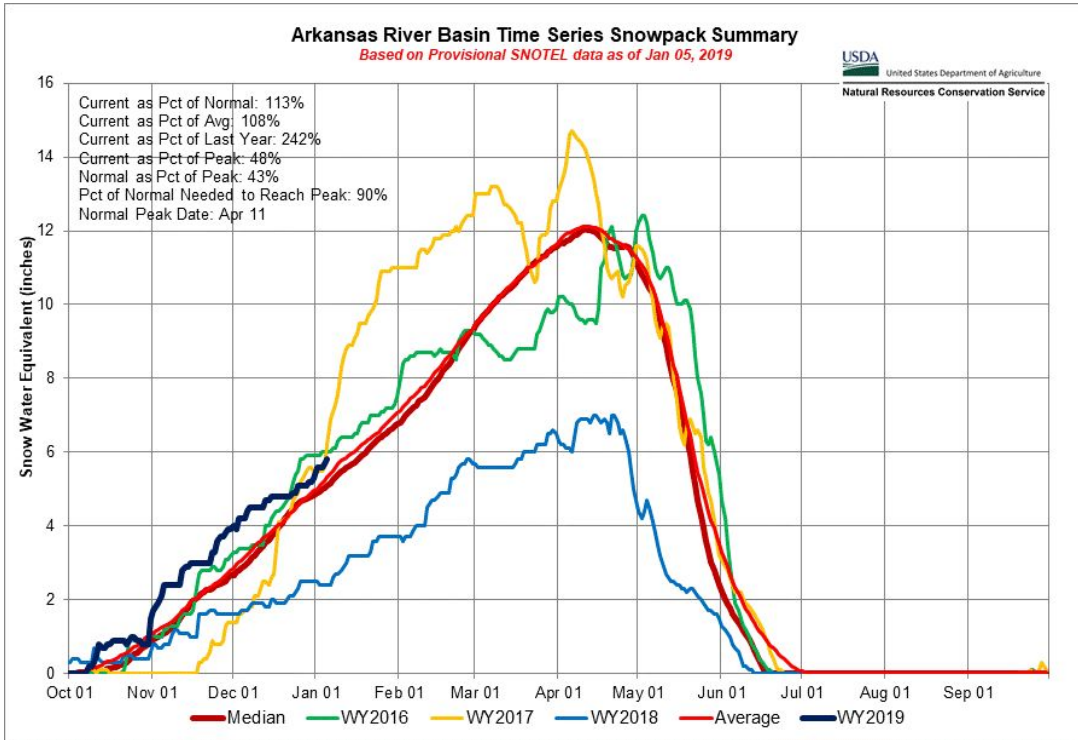


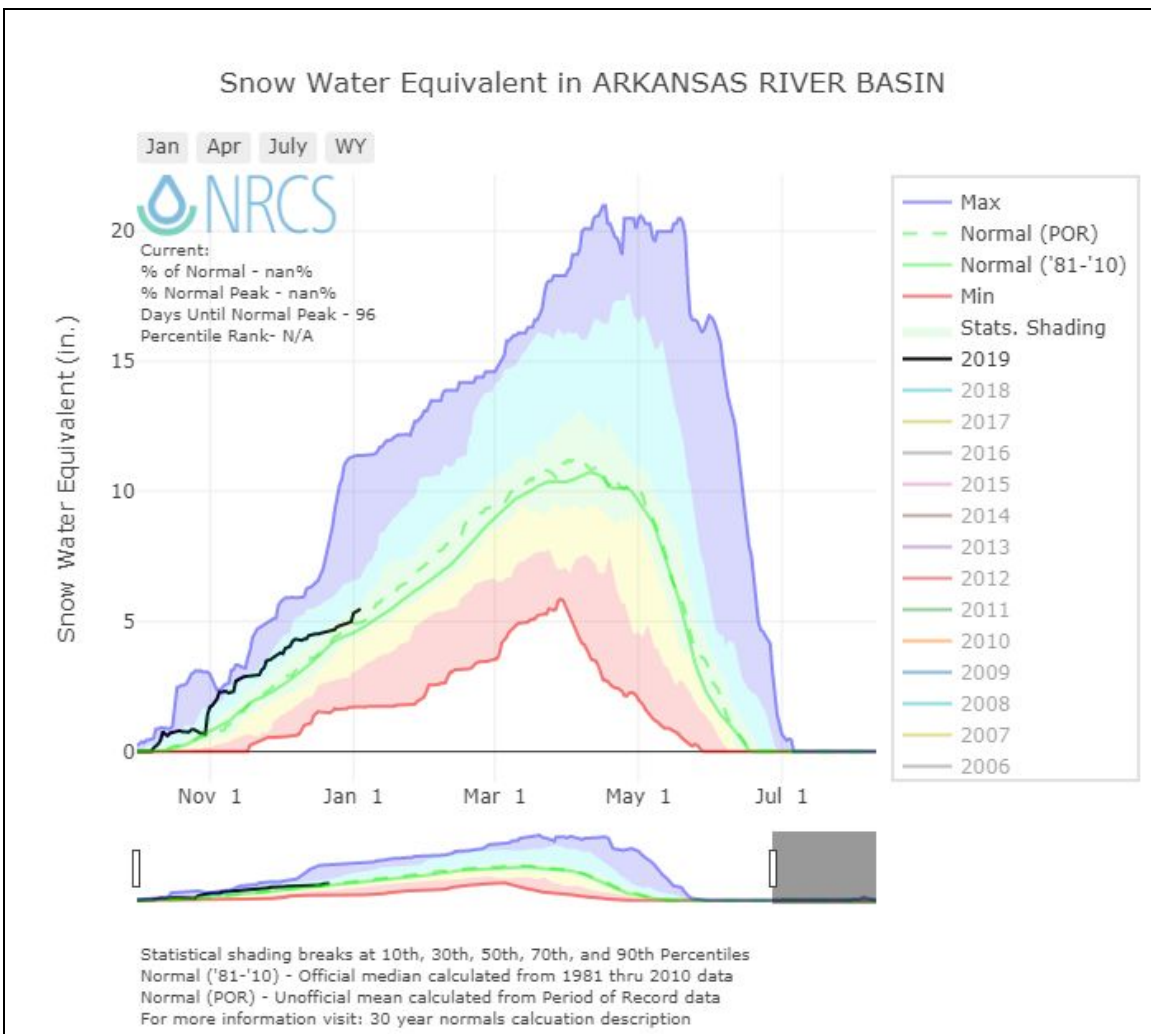
At the hut location, the SWE to date is slightly above the median.



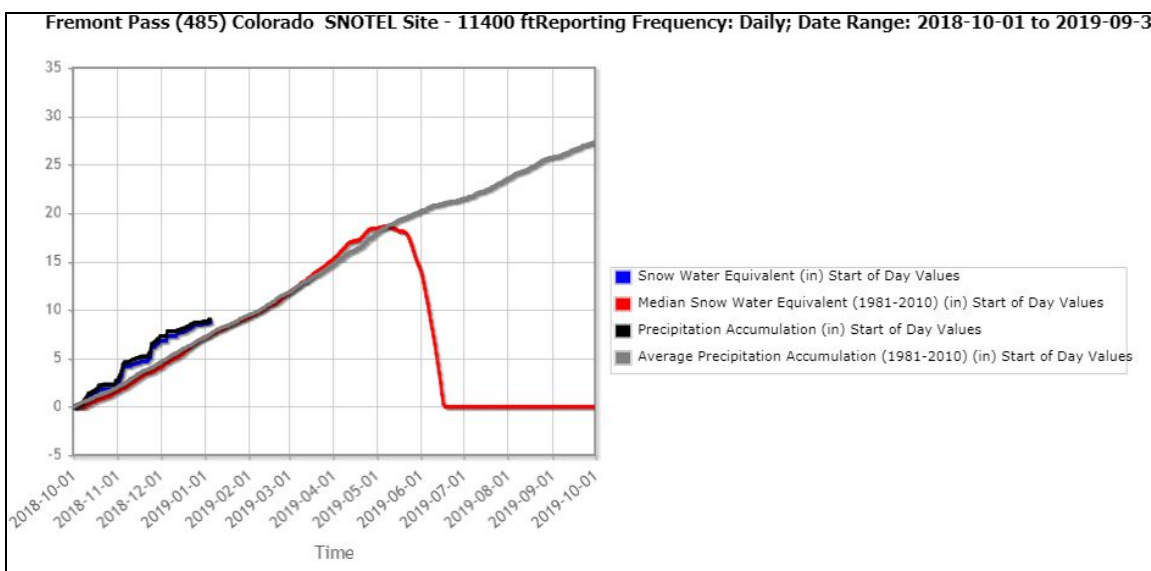
The plots below show the progression of SWE and precipitation to date. We see that so far, SWE and precipitation amount have been slightly above the average.

Arkansas River Basin Snow Water Equivalent year to date:

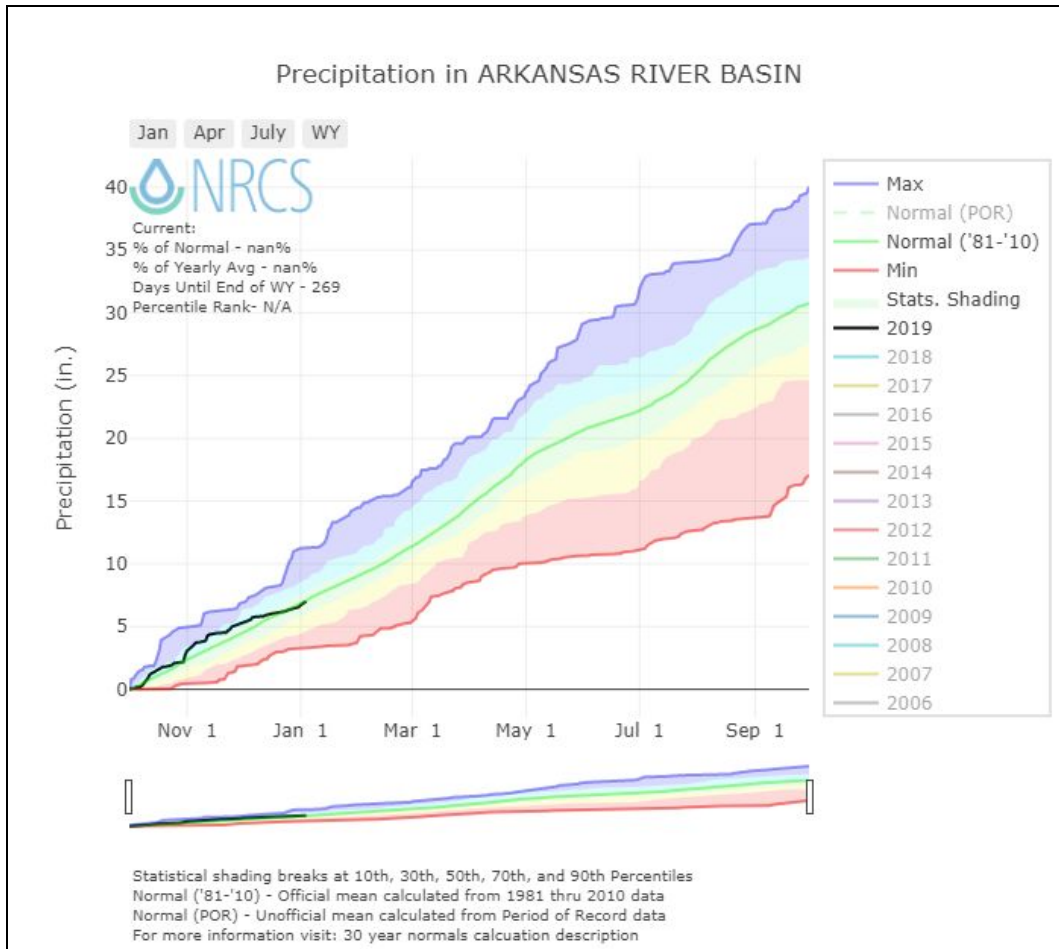




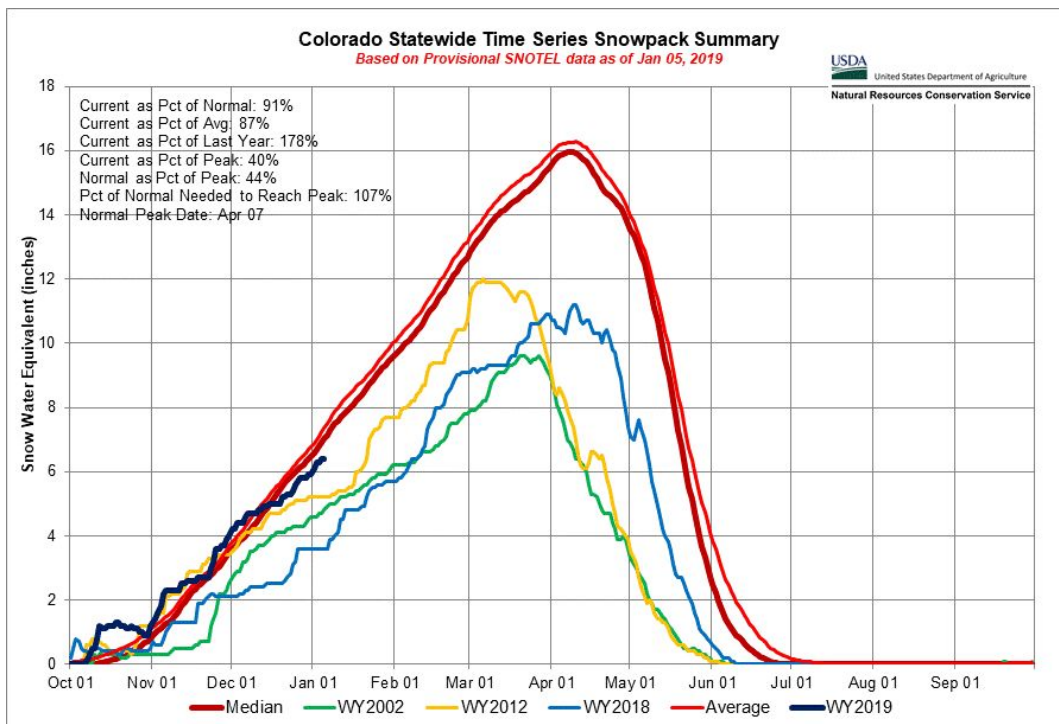
Fremont Pass Snotel Site SWE:



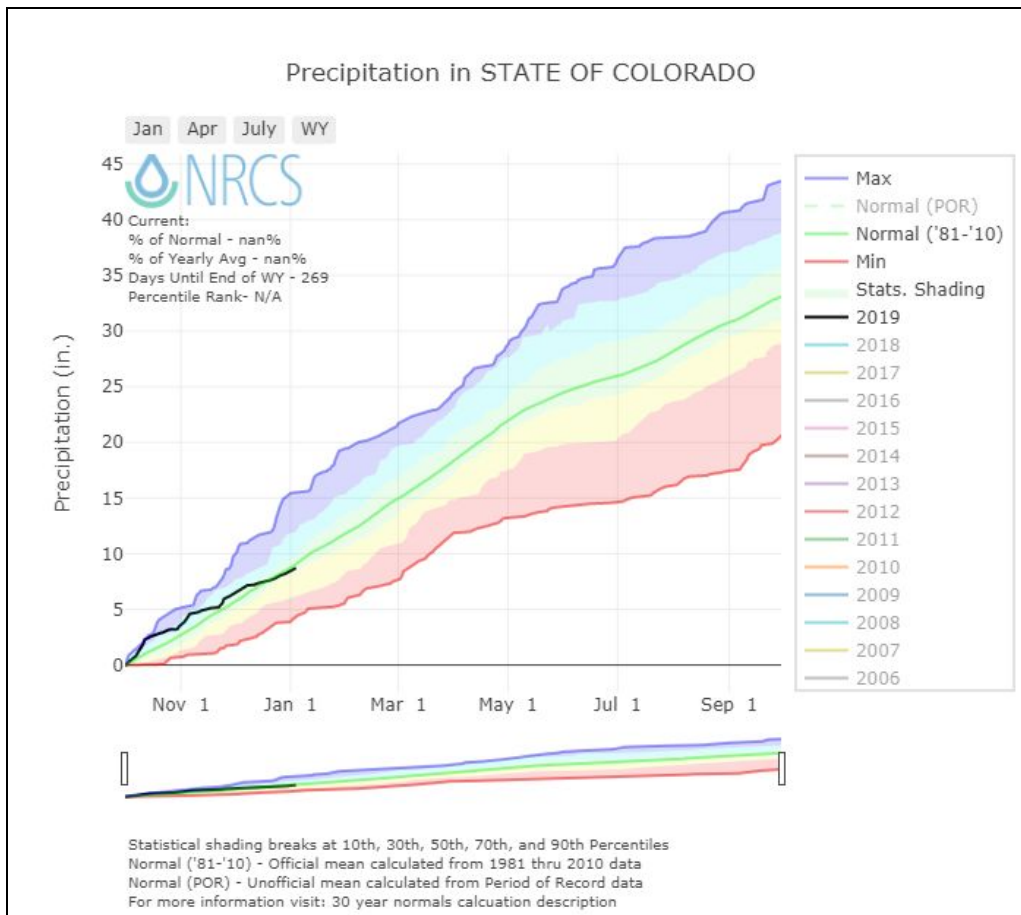
Precipitation in the Arkansas River Valley to date:



Statewide Snow Water Equivalent to date:



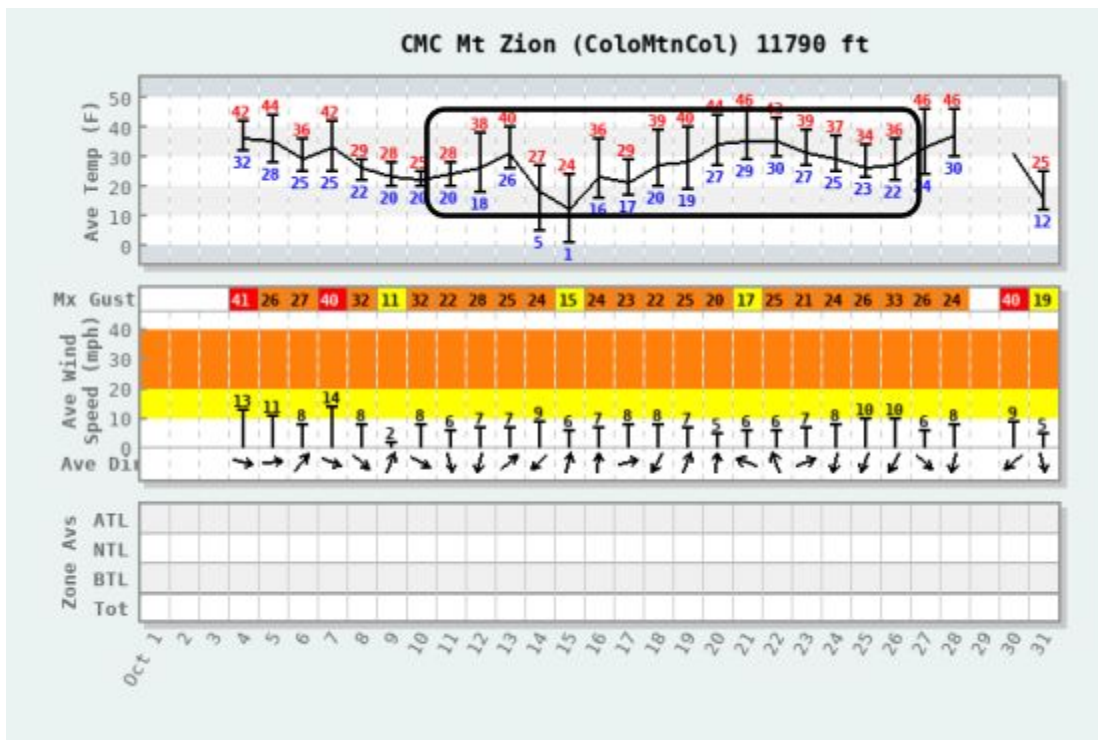
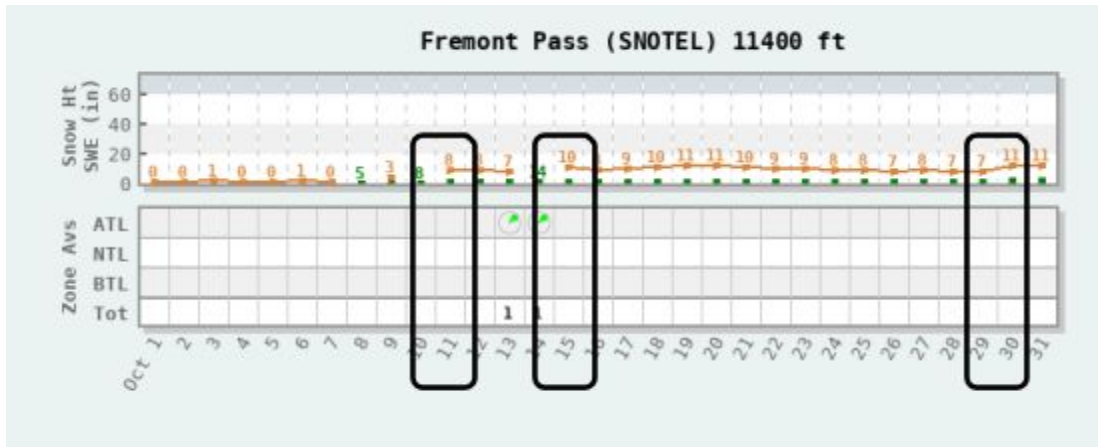
Statewide Precipitation to date:



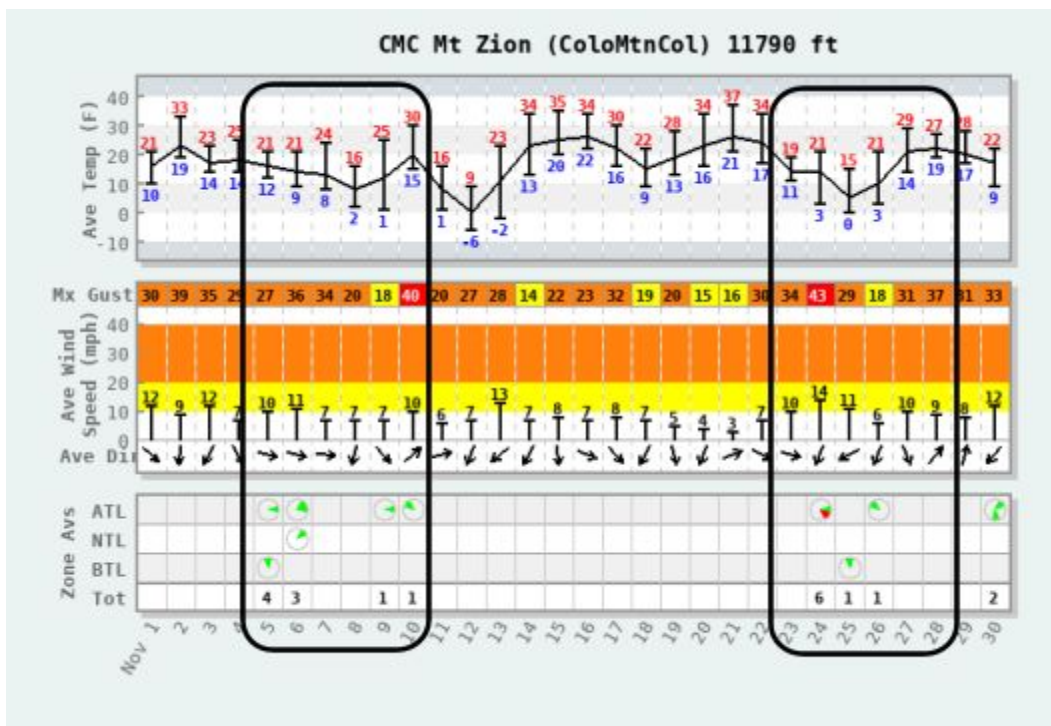
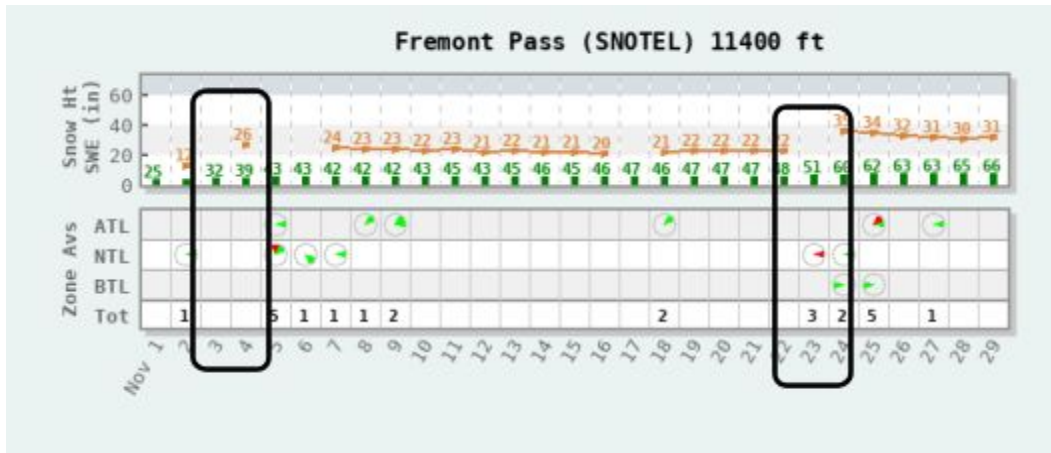
Looking at the data from weather stations close to the hut, we can identify the major weather events to date. The Fremont Pass Snotel site gives good information on snow events, along with temperature, wind directions and wind speed. The Mt. Zion weather station helps with ridgetop wind speed and direction, as well as temperatures.

Local Weather, Season to Date:

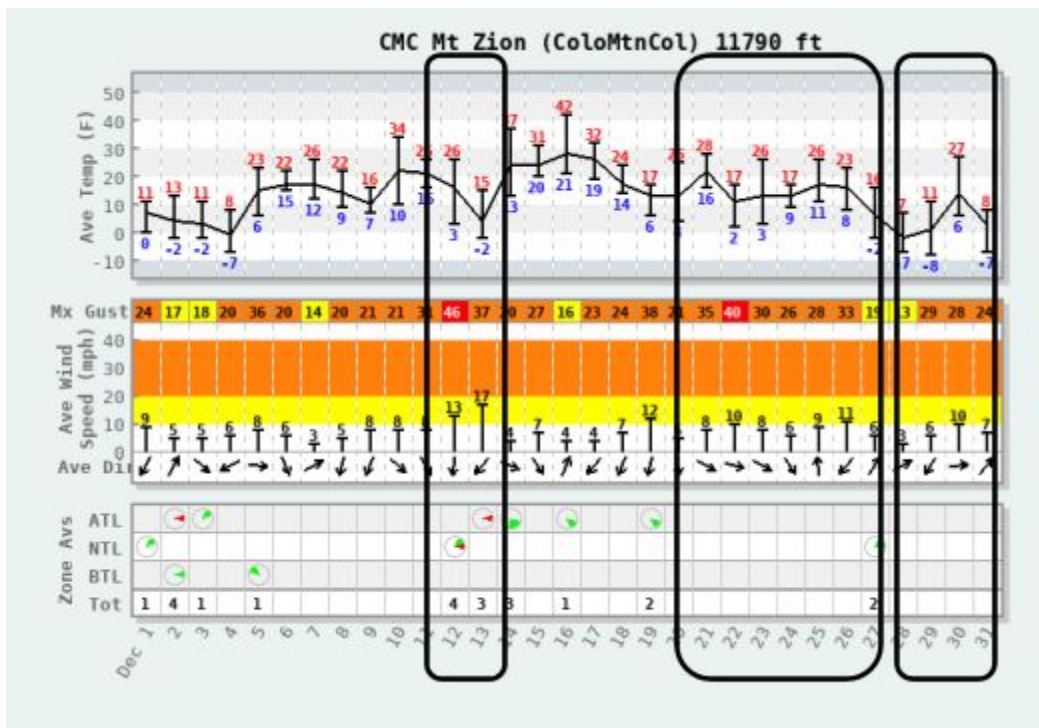
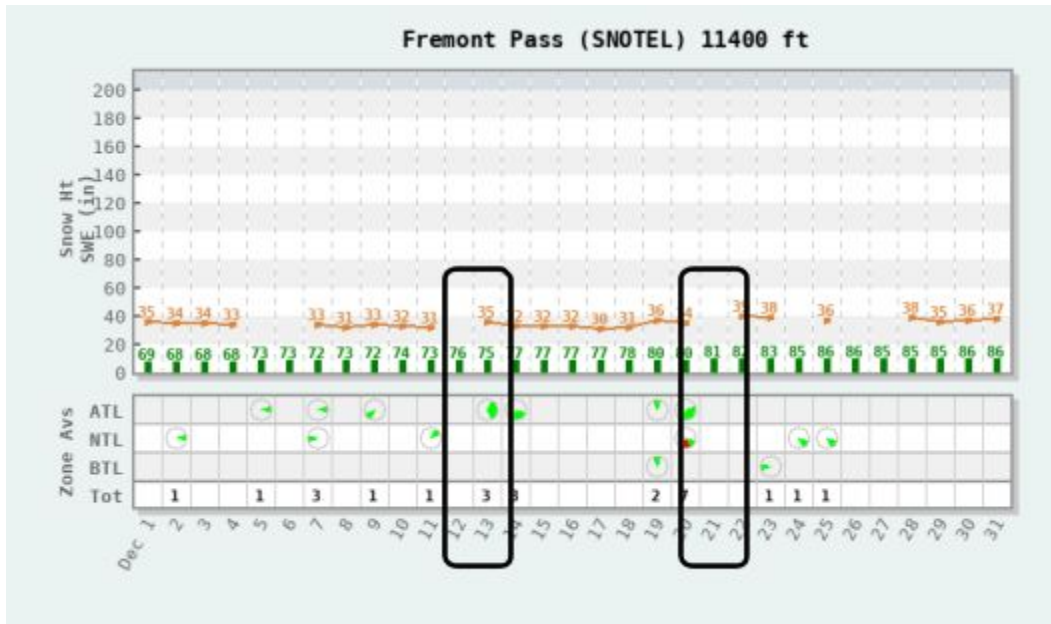
October 2018:



November 2018:



December 2018:

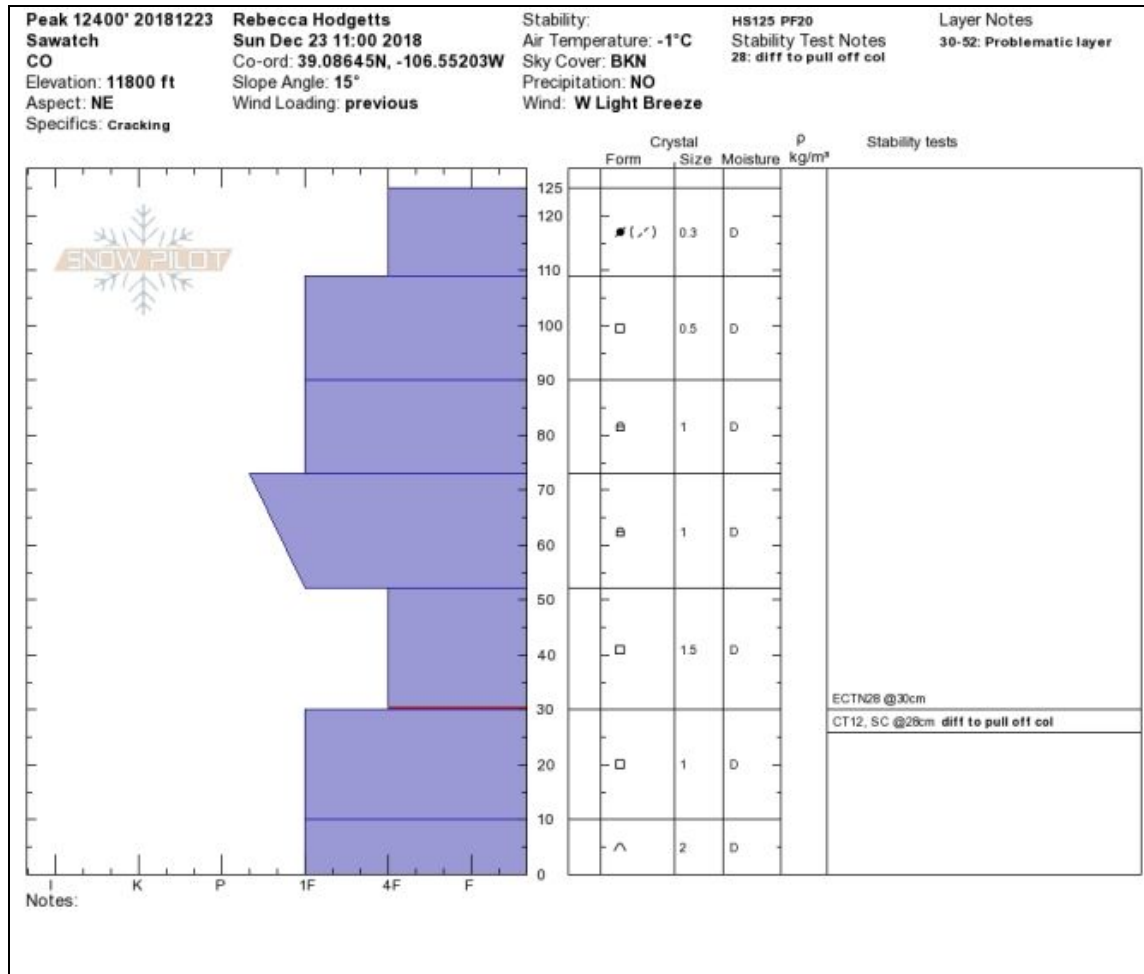


Seasonal Snowpack Summary for the Zone:



NTL, WNW aspect, HS 60-80cm, facet dominating snowpack with layer/interface of concern ~35cm from the ground.

A similar snowpack structure found in the Sawatch Zone (NE facing, 11,800 ft):



East Independence pass, 11,800 ft, NE aspect, December 23 2018

Facets dominate the middle-lower snowpack in ATL and NTL elevation bands. These faceted weak layers are most prominent on north, northeast, east and southeast slopes.

Wind drifted slabs exist ATL and NTL on lee slopes just below ridgetops. Recent winds have been drifting snow onto northeast, east, southeast and south aspects.

NE, E, SE slopes ATL and NTL contain both a facet dominated mid-lower snowpack with wind drifted slabs formed above these weak layers.

Avalanche Observations in the Area:

Around the time of our site survey, some skier triggered avalanches were observed in the area. The details of some of these are noted below:

Skier triggered avalanches in North Fooses Creek:

Date	Location/Path	#	Elev	Asp	Type	Trig	SizeR	SizeD
2018/12/12	Monarch Pass	1	TL	NE	HS	AS / r	R1	D1.5
<ul style="list-style-type: none"> Date: 2018/12/12 Time: 11:00 AM Observer: Jason Konigsberg, Ben Pritchett Organization: Forecaster, CAIC Area Description: Fooses Creek Landmark: Monarch Pass <ul style="list-style-type: none"> Comments: Avalanche on old bed surface of an avalanche ~week ago 								
2018/12/12	Monarch Pass	2	TL	E	HS	AS / c	R1	D1
<ul style="list-style-type: none"> Date: 2018/12/12 Time: 1:00 PM Observer: Jason Konigsberg, Ben Pritchett Organization: Forecaster, CAIC Area Description: Foose Creek Landmark: Monarch Pass <ul style="list-style-type: none"> Comments: Small Wind Slab avalanches 								
2018/12/12 †	Monarch Pass	1	TL	E	HS	AS / r	R1	D1
<ul style="list-style-type: none"> Date: 2018/12/12 (Estimated) Observer: Jason Konigsberg, Ben Pritchett Organization: Forecaster, CAIC Area Description: Fooses Creek Landmark: Monarch Pass <ul style="list-style-type: none"> Comments: Triggered from either one of the avalanches listed in this ob or from skiing a few hundred feet away on lower-angle slopes. This avalanche was a Persistent Slab avalanche and not a wind slab. 								

Skier triggered avalanche on Buckeye Peak, near the hut:



Skier triggered avalanche on Buckeye Peak on a South facing aspect, ATL, December 14, 2018

Date	Location/Path	#	Elev	Asp	Type	Trig	SizeR	SizeD
2018/12/14	Other	1	>TL	S	HS	AS / u	R2	D1.5
<ul style="list-style-type: none"> Date: 2018/12/14 Time: 1:45 PM Observer: Becs Hodgetts Organization: Forecaster, CAIC Area Description: South slopes below Buckeye Peak Landmark: Other Average Slope Angle: 30 ° Maximum Slope Angle: 40 ° Elevation: 12300 ft 				<ul style="list-style-type: none"> Sliding Surface: I - New/Old Interface Weak Layer: Interface Weak Layer Grain Type: Faceted Crystals Average Crown: 24 in Maximum Crown: 36 in Maximum Width: 130 m Average Vertical: 100 m Maximum Vertical: 200 m 				

Natural avalanche on Fremont Pass, December 19, 2018:



NE facing slope NTL. Source: Colorado Avalanche Information Center, Jason Konigsberg

Natural avalanches in Buckeye Gulch 1/12/2019:

Date	Location/Path	#	Elev	Asp	Type	Trig	SizeR	SizeD
2019/01/12 †	Other	1	>TL	SE	U	U	R1	D1.5
<ul style="list-style-type: none"> Date: 2019/01/12 (Estimated) Observer: Jason Konigsberg Organization: Forecaster, CAIC Area Description: Buckeye Peak Landmark: Other 								
2019/01/12 †	Other	1	TL	SE	HS	N	R1	D1
<ul style="list-style-type: none"> Date: 2019/01/12 (Estimated) Observer: Jason Konigsberg Organization: Forecaster, CAIC Area Description: Mt Zion Landmark: Other Elevation: 12000 ft Sliding Surface: O - Within Old Snow Weak Layer: Layer Weak Layer Grain Type: Faceted Crystals Average Crown: 18 in Average Width: 100 ft 								
2019/01/12 †	Other	1	TL	SE	HS	N	R2	D2
<ul style="list-style-type: none"> Date: 2019/01/12 (Estimated) Observer: Jason Konigsberg Organization: Forecaster, CAIC Area Description: Southwest of Sangree Hut, south of Pt 12156 Landmark: Other Maximum Slope Angle: 40 ° Elevation: 11800 ft Sliding Surface: O - Within Old Snow Weak Layer: Layer Weak Layer Grain Type: Faceted Crystals Average Crown: 36 in Maximum Crown: 80 in Average Width: 500 ft Average Vertical: 100 ft Maximum Vertical: 100 ft 								
2019/01/12 †	Other	2	TL	E	HS	N / y	R1	D1
<ul style="list-style-type: none"> Date: 2019/01/12 (Estimated) Observer: Jason Konigsberg Organization: Forecaster, CAIC Area Description: South of large slide in this observation Landmark: Other Comments: It is likely that these two small avalanches released at same time as larger ones. Cracking throughout the basin. 								

Critical avalanche factors at that time are summarized as follows:

- Recent natural and AS triggered wind slab avalanches occurring on NE, E, SE aspects ATL and NTL.
- Stubborn persistent slab problem still exists and continues to produce avalanches.
- Triggering a wind slab avalanche could potentially step down into a much larger persistent slab avalanche.

Site Specific Snow profile and Snowpack Tests

Five snow study sites were identified around the area of travel and are summarized in section 3.3.3.1. They were chosen to provide data on different aspects and elevation. Below is a summary of the snowpack conditions found and instability test results.

Study Site 1:

N trees Zion
Fremont Pass
CO
 Elevation: **11550 ft**
 Aspect: **E**
 Specifics:

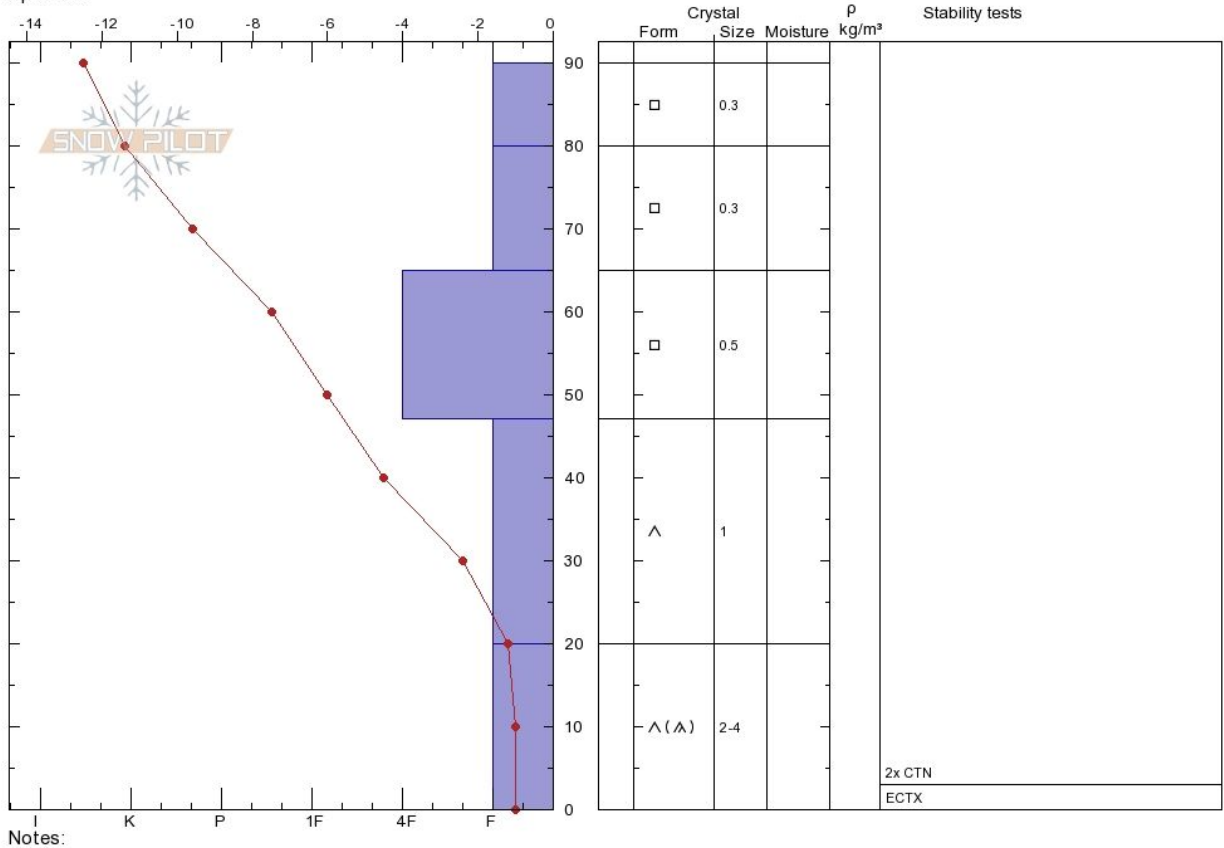
Chris Peterson
Sat Dec 15 14:10 2018
 Co-ord:
 Slope Angle: **21°**
 Wind Loading:

Stability:
 Air Temperature: **-1.8°C**
 Sky Cover: **FEW**
 Precipitation: **NO**
 Wind: **Calm**

HS90 PF65

Layer Notes

Stability Test Notes

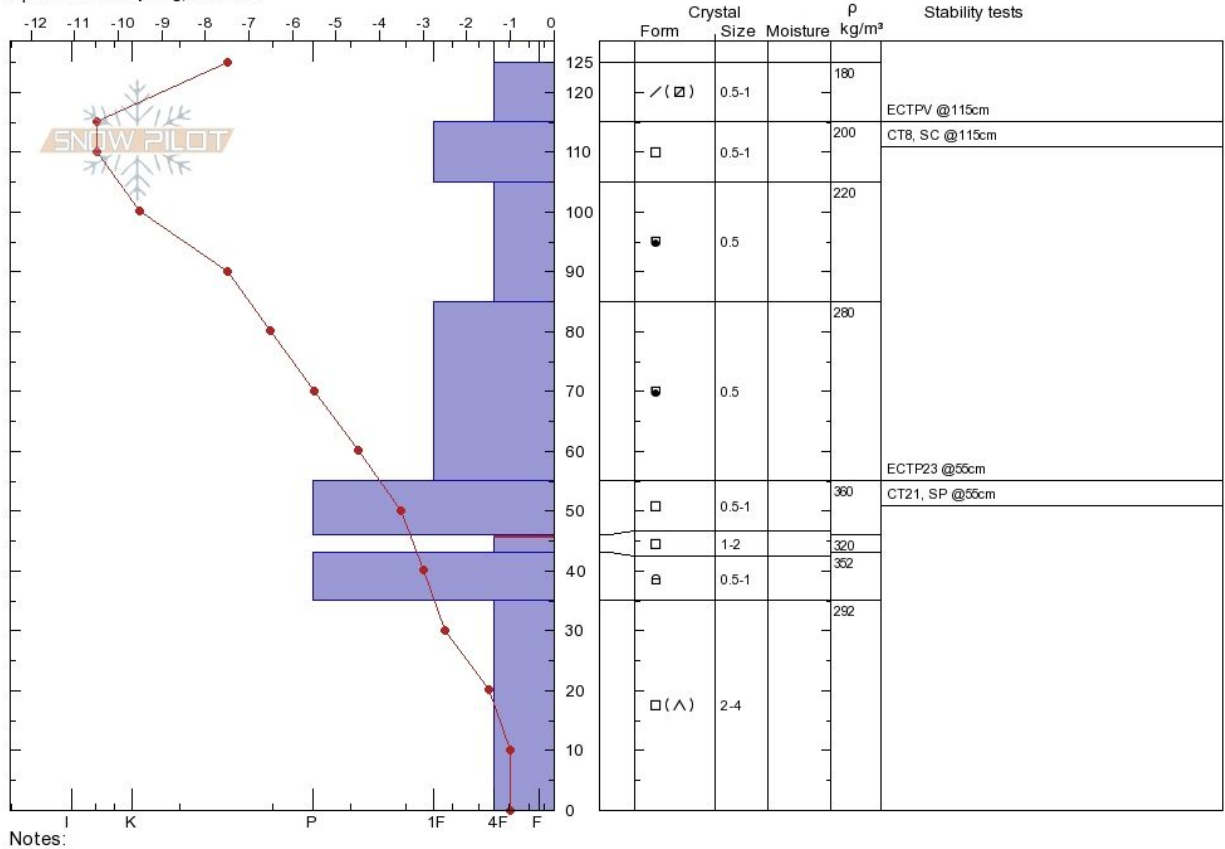


Study Site 2:

Buckeye-Mt Zion Pit 2 **Zach Wade**
Sawatch **Fri Dec 14 12:20 2018**
CO **Co-ord: 13S 390274E 4353016N**
 Elevation: **11800 ft** Slope Angle: **29°**
 Aspect: **120°** Wind Loading: **previous**
 Specifics: **Collapsing, localized**

Stability: **HS125 PF30**
 Air Temperature: **-2.5°C** **Stability Test Notes**
 Sky Cover: **CLR**
 Precipitation: **NO**
 Wind: **W Light Breeze**

Layer Notes
43-46: Problematic layer



Study Site 4:

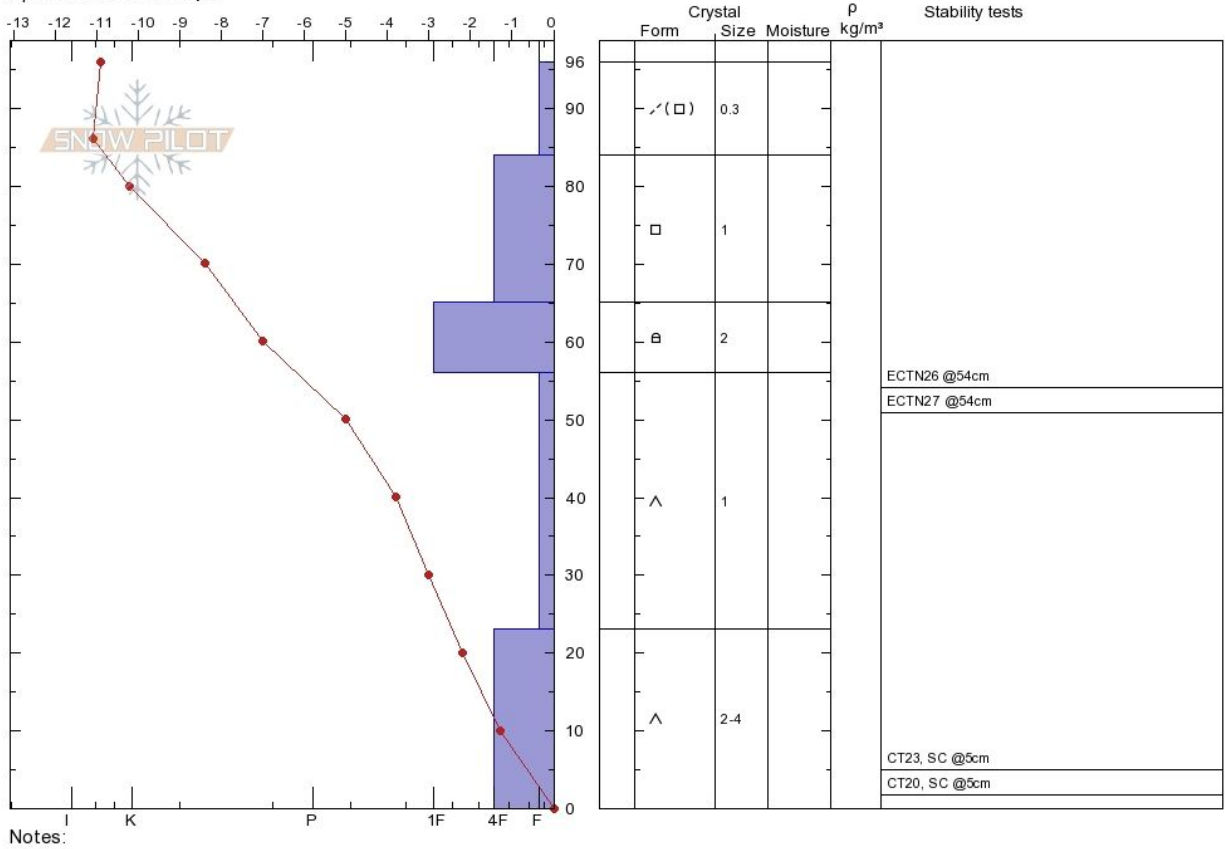
E Trees near Sangree
Sawatch
CO
 Elevation: **11750 ft**
 Aspect: **90°**
 Specifics: **We skied slope**

Nolan Van Harte
Sat Dec 15 14:15 2018
 Co-ord: **13S 392175W 4353948N**
 Slope Angle: **20°**
 Wind Loading:

Stability: **Good**
 Air Temperature: **-4°C**
 Sky Cover: **FEW**
 Precipitation: **NO**
 Wind: **W Light Breeze**

HS96 PF75
 Stability Test Notes

Layer Notes
0-23: Problematic layer



Study Site 5:

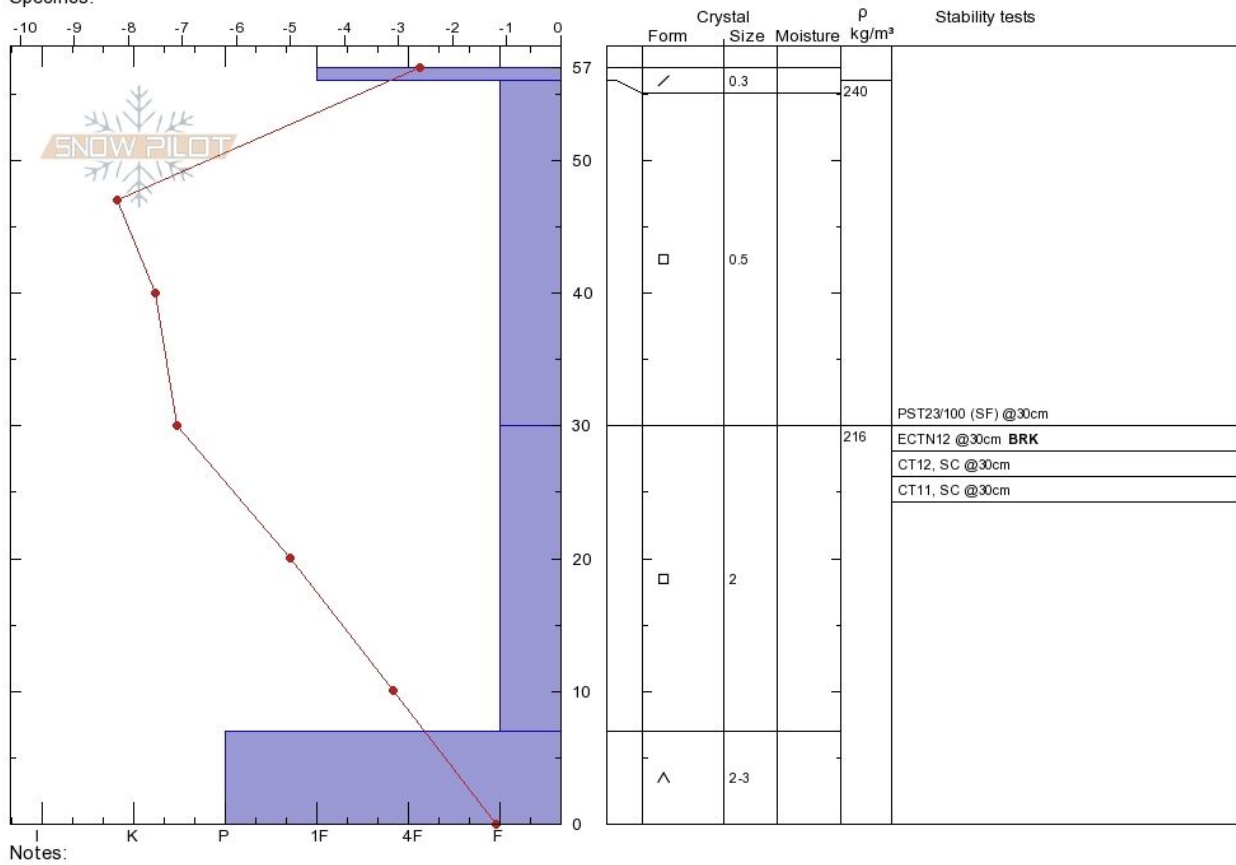
W glds. Buckeye Gulch
 Fremont Pass
 CO
 Elevation: 11700 ft
 Aspect: W
 Specifics:

Chris Peterson
 Sat Dec 15 12:10 2018
 Co-ord:
 Slope Angle: 15°
 Wind Loading:

Stability:
 Air Temperature: -1°C
 Sky Cover: FEW
 Precipitation: NO
 Wind: W Light Breeze

HS57 PF50
 Stability Test Notes
 30: BRK

Layer Notes

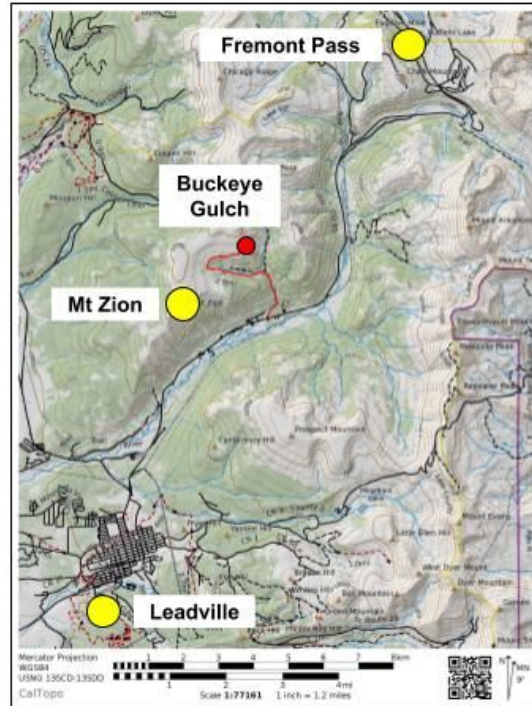


3.3.2 Existing Remote, Telemetered Weather Stations in the Region

We will use information from at least three weather stations that exist near the Buckeye Gulch permit area:

Fremont Pass, 11,301 ft, north of Buckeye Gulch
Mt. Zion, 11,790 ft, southwest of Buckeye Gulch
CMC Leadville, 10,025 ft,
further southwest of Buckeye Gulch

The Fremont Pass Snotel site provides information about precipitation, temperature, and wind speed and direction. The Mt. Zion weather station provides temperature and wind speed and direction. CMC Leadville provides weather station provides information about precipitation, temperature, wind speed and direction, height of snow, and more.



3.3.3 Weather and Snowpack Data Collection Scheme

Develop a weather and snowpack data collection scheme to support ongoing coursework operations in this zone:

Weather and Snowpack Data Collection

Each course gathers data from snow study plots, weather stations, and other means (visual observations, etc), so we can create a snowpack history for the season to be used for programming. Specifically, each course in the field will try to visit all designated snow study sites and perform full profiles, if conditions and student skills allow. See also below, 3.3.3.1.2 Frequency Plan, for details on weather data gathering.

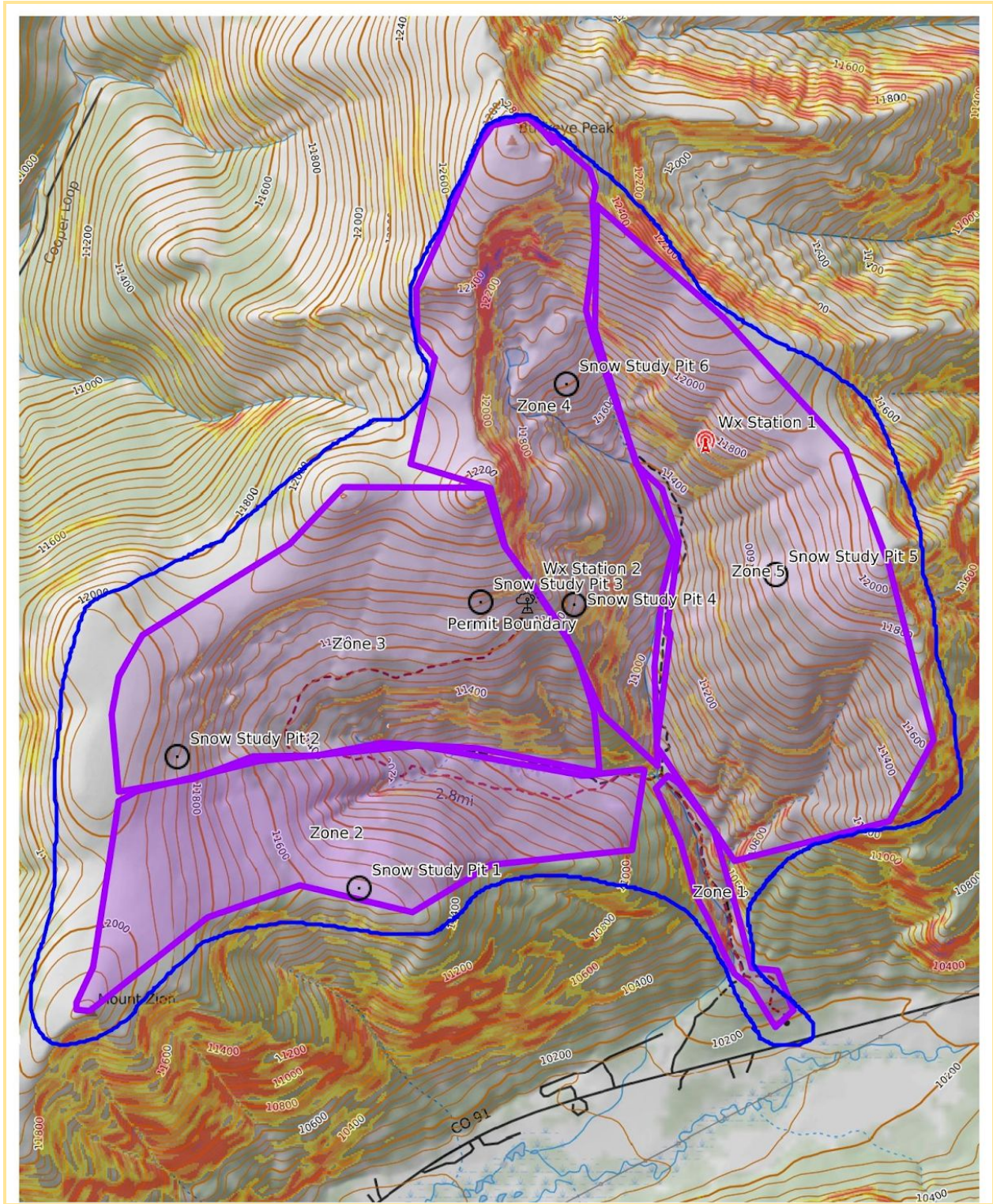
The data gathered will be stored at both the hut and brought back to the college campus.

Other information will be kept with this data as well:

- Students' observations
- CAIC avalanche professionals discussions and forecasts

3.3.3.1 Key Snowpack and Weather Study Plots

Five snow study sites were identified around the area of travel and are summarized below. They were chosen to provide data on different aspects and elevation.



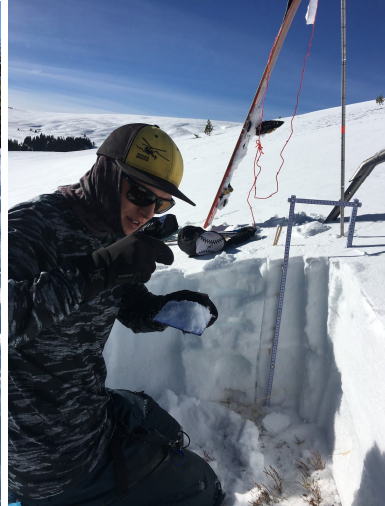
Study Site	Aspect	Elevation	Slope Angle	Notes
1	ENE	11550'	21	Easily accessible from the Hut ingress route
2	ESE	11800'	29	On Z3 run
3	S	11700'	19	On Breakfast Run, just uphill of the hut
4	E	11750'	20	In the trees
5	W	11700'	15	On the Westward Ho! run



Snow Study Site 1



Snow Study Site 2



Snow Study Site 3



Snow Study Site 4



5now Study Site 5

3.3.3.1.1 Snow Study Data List

Develop prioritized list of data to be collected at sites.

Collecting data is important to the program. A full profile shall be conducted at each study site on each course that goes to the hut, if feasible (as avalanche and weather conditions and group skill level allows). Attempts to perform test profiles should be conducted when full profiles are not feasible. Target sites should be used to aid evaluation of problems of concern. Priority should be given to evaluating problems of concern prior to skiing a slope similar to the problem of concern.

The collected data will be used to build a history of the snowpack for the season, support trip planning and decision making, and meet student learning objectives. The collected data shall follow Snow, Weather, Avalanche guidelines (SWAG), be kept in a common location, and made easily accessible for all instructors.

Example List of Data to Collect:

Observer Full Name, Time, Date, Location, Elevation, Aspect, Slope Angle, Sky Cover, Wind Direction/Speed/Gusts, Blowing Wind/Extent/Direction, HS, Ski/Boot Pen, Temperature: air; snow surface; T10, by depth, Layer: boundary ID; hand hardness; grain type and size; density, if possible, and snow stability tests: CT; ECT; and PST.

3.3.3.1.2 Frequency Plan

Develop frequency plan for visits.

The manual weather station will be visited daily during a course.

As noted above, an attempt will be made to get to all snow study sites at least once on each course visit to the hut. This will result in a history of the seasonal snowpack. Each course will build on the information gained from the participants and staff of the previous course. The information must be reviewed by course leaders to ensure accuracy and legibility of the data.

Students will practice pit skills and instability testing at other sites as well.

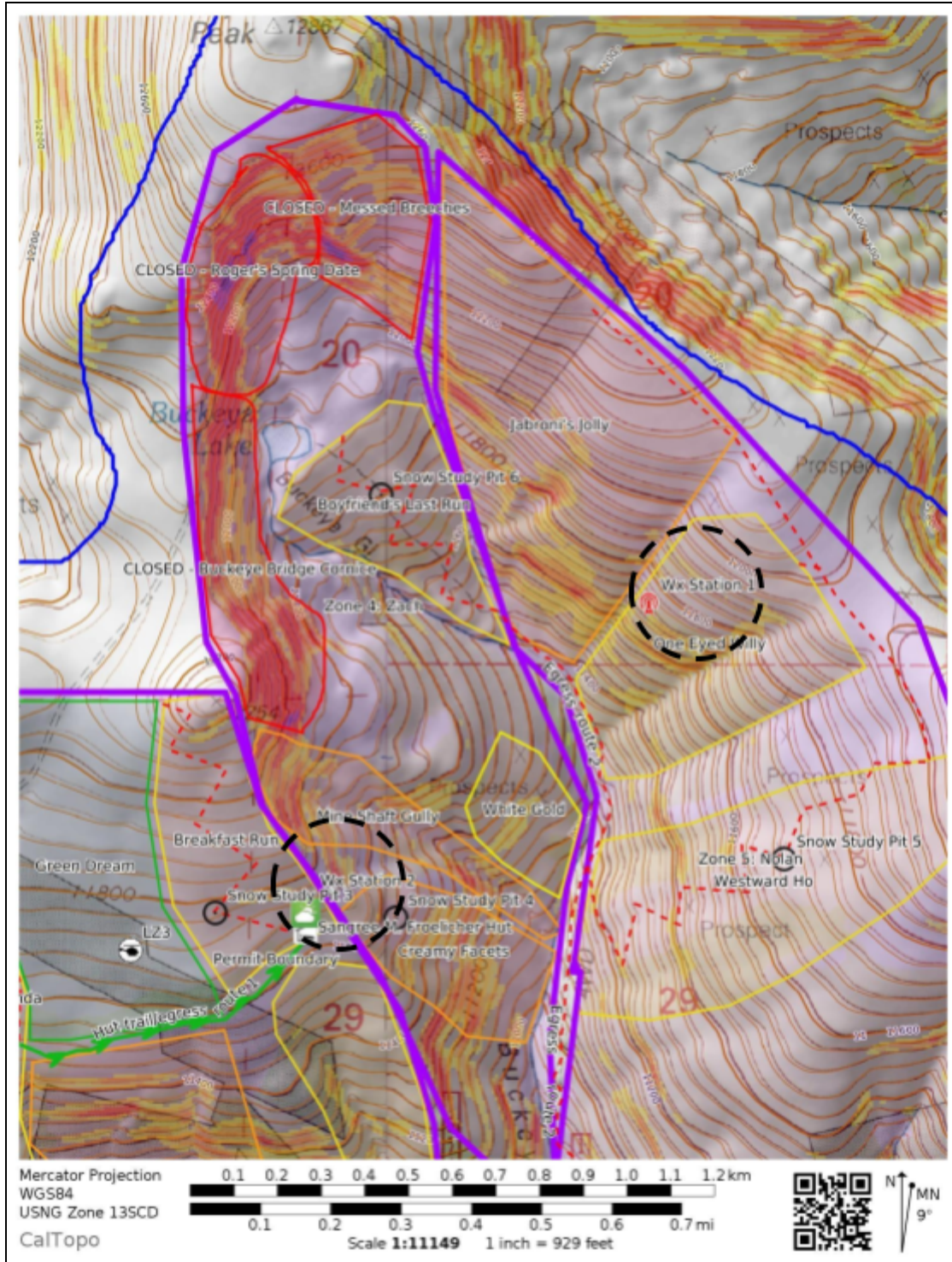
3.3.3.2 Remote, Telemetered Weather Station

Identify an appropriate location(s) to install one or more remote, telemetered weather stations to provide real-time data. (Justify all decisions - location, number, etc.).

Note: see below for a table summarizing the weather station details.

We propose two weather stations be installed to provide additional information for trip planning, risk reduction, and education.

The two weather stations are marked on the image below as “Wx Station 1” and “Wx Station 2”:



Weather Station 1:

The first proposed weather station is a remote, telemetered station. This weather station would provide crucial data on near tree line elevations and be located in an area that is likely for ski missions.

While the Mt. Zion weather station gives good information about ridgetop winds and temperatures, Weather Station 1 would provide localized data on lower elevations and height of snow (HS). These data are needed for understanding how the snow is moving in the zone and possibly loading.

With cell connection available at the hut, the data from this station can be viewed from afar for daily decision making.

Weather Station 2:

Weather Station 2 is located close to the hut and features a combination of devices for manual measurements as well as automated instruments (temperature and wind) connected to a data logger.

The purpose of this station is two-fold:

1. The data from this station provides a good representation of the zone near the hut, which will be skied frequently.
2. The site provides great educational opportunities for students in the course to learn manual weather observations and collection techniques.

Due to the availability of reliable cell connection around the area of the hut, we are providing the option of having the data for Weather Station 2 upload via cell connection. This is a relatively inexpensive option that could provide great benefit in trip planning and risk management.

3.3.3.2.1 Weather Station Parameters

Detail parameters to be collected (instruments, etc.)

Weather Station 1:

1. Anemometer
2. Thermometer
3. Relative Humidity
4. HS

Weather Station 2 is located close to the hut. It consists of:

1. A measurement stick to track HS
2. A snow board for manual measurements of HST and SWE
3. Thermometer/RH probe that connects to data logger
4. Anemometer for wind speed and direction that connects to data logger

5. Data logger
6. *Optional: cellular modem to upload temperature and wind data*

3.3.3.2 Weather Station Data Collection Frequency

Detail frequency of collection of each parameter (hr, day, etc.).

Weather Station 1:

Weather Station 1 would upload data every hour via telemetry.

Weather Station 2:

Manual observations at Weather Station 2 will be performed daily every morning when in the field.

The data logger at Weather Station 2 will record the automated instruments every hour.

3.3.3.2.3 Remote Station Data Transmission Plan

Detail data transmission plan for remote stations (on-site, radio, cell, etc.).

Weather Station 1:

1. Option 1: Radio link from Wx Station 2 site to hut, and then from hut upload over cellular connection as with Wx station 2.
 - a. Campbell RF451 900 MHz 1 W Spread-Spectrum Radio
2. Option 2: Satellite uplink directly from Wx Station 1
 - a. Campbell TX321 Satellite Transmitter for GOES or Meteosat



Weather Station 2:

1. For the manual weather observations, a notebook shall be kept at the hut where all weather observations and measurements are kept. Photographs of this notebook shall be taken and brought back to campus and transferred to a record there.
2. Campbell CR300 Data Logger for logging anemometer and thermometer data
3. Campbell CR300-CELL205 providing 3G/4G cell internet connection to upload data if opted for.



Summary Table for weather station details:

	Wx Station 1	Wx Station 2
Location	Zone 5, 11,740 ft, NTL in sheltered, treed area	Close to the hut, 11693 ft
Instruments	<ol style="list-style-type: none"> 1. Anemometer 2. Thermometer 3. Relative Humidity 4. HS 	<ol style="list-style-type: none"> 1. A measurement stick to track HS 2. A snow board for manual measurements of HST and SWE 3. Thermometer/RH probe that connects to data logger 4. Anemometer for wind speed and direction that connects to data logger 5. Data logger 6. <i>Optional: cellular modem to upload temperature and wind data</i>
Collection frequency	Hourly	<i>Manual Measurements: Daily Logged Measurements: Hourly</i>
Transmission Plan	<p><i>Option 1:</i> Radio Communication to hut, then cell to upload</p> <p><i>Option 2:</i> Satellite upload at Wx station site.</p>	<p><i>Option 1:</i> Manual recording of data and data logging of instruments</p> <p><i>Option 2:</i> add cellular capability to upload data</p>

3.3.3.2.4 Stations Rough Cost Estimate

Provide a rough cost estimate for station(s) including instruments, power, hardware and communications (get a quick quote from Campbell Sci. for instruments).



Images of some of the measurement equipment for the weather stations. Solar panel, Sonic Distance Sensor (for snow depth measurements), Anemometer, Data Logger, Temperature and RH probe

Table 1 of 4: General Equipment required for both stations:

Needed For Both Wx Stations:					
Subsystem	Model	Purpose	Cost Each	Quantity	Total
Power	SP20 20 W Solar Panel	Solar Panels	\$ 323.00	2	\$ 646.00
	PS150 12 V Power Supply with Charging Regulator and 7 Ah Sealed Rechargeable Battery	Battery and Charge Regulator	\$ 305.00	2	\$ 610.00
Enclosures	ENC8/10-SC-NM Weather-Resistant 8 x 10 inch Enclosure	Enclosures	\$ 170.00	2	\$ 340.00
Towers	10 ft Tower with Base, Adjustable Mast, and Grounding Kit	Towers	\$ 625.00	2	\$ 1,250.00
			TOTAL, REQ'D EQPMT FOR BOTH STNS: \$ 2,846.00		

Table 2 of 4: Equipment specifications for Weather Station 1:

Weather Station 1					
Weather Instruments	05108-45-L, Wind Monitor-HD, Alpine Version	Anemometer	\$ 1,855.80	1	\$ 1,855.80
	EE181-L Air Temperature and Relative Humidity Probe	Air temp and RH	\$ 485.90	1	\$ 485.90
	SR50A-L Sonic Distance Sensor	for HS measurement	\$ 961.40	1	\$ 961.40
TOTAL FOR WX INSTRUMENTS:					\$ 3,303.10
Wx Station 1 Option 1: Radio System					
Radio Components	CR300-RF407	data logger with built in radio	\$ 915.00	1	\$ 915.00
	RF407 900 MHz Spread-Spectrum Radio	radio for receiving side	\$ 385.00	1	\$ 385.00
	14201 900MHz 9dBd Yagi Antenna w/Type N Female & Mounting Hardware	antenna	\$ 155.00	2	\$ 310.00
	31314 Surge Protection Kit, Type N to RPSMA, 700-2700MHz, 18 inches	lightning protection	\$ 225.00	2	\$ 450.00
TOTAL FOR RADIO COMPONENTS:					\$ 2,060.00
Wx Station 1 Option 2: Satellite System					
Satellite Components	TX321 Satellite Transmitter for GOES or Meteosat	satellite transmitter	\$ 2,495.00	1	\$ 2,495.00
	25316 GOES 11dBi Yagi RHCP Antenna w/Mounting Hardware	Antenna	\$ 630.00	1	\$ 630.00
	31329 Surge Protection Kit, Type N to N, 100-512MHz, 18 inches	lightning protection	\$ 225.00	1	\$ 225.00
	CR300	Data logger	\$ 695.00	1	\$ 695.00
TOTAL FOR SATELLITE COMPONENTS:					\$ 4,045.00
TOTALS, WX STATION 1:					
WX STATION 1, RADIO SETUP:					\$ 5,363.10
WX STATION 1, SATELLITE SETUP:					\$ 7,348.10

Table 3 of 4: Equipment specifications for Weather Station 2:

Weather Station 2					
Weather Instruments	05108-45-L, Wind Monitor-HD, Alpine Version	Anemometer	\$ 1,855.80	1	\$ 1,855.80
	EE181-L Air Temperature and Relative Humidity Probe	Air temp and RH	\$ 485.90	1	\$ 485.90
TOTAL FOR WX INSTRUMENTS:					\$ 2,341.70
Wx Station 2 Option 1: Local System Only					
Data Logger	CR300-NA	data logger	\$ 695.00	1	\$ 695.00
TOTAL FOR DATA LOGGER COMPONENTS:					\$ 695.00
Wx Station 2 Option 2: Cellular System					
Cellular Components	CR300-CELL205-ND	data logger with built in 3G/4G	\$ 995.00	1	\$ 995.00
	32262 4G/3G Omni 2dBd Antenna w/Type N Female & CSI Mounting Hardware	Antenna	\$ 98.00	1	\$ 98.00
	31314 Surge Protection Kit, Type N to RPSMA, 700-2700MHz, 18 inches	lightning protection	\$ 225.00	1	\$ 225.00
TOTAL FOR CELLULAR COMPONENTS:					\$ 1,318.00
Wx Station 2 Manual Weather Observations Components					
Manual Components	Snow Board with hardware	snowmetrics	\$ 72.00	2	\$ 144.00
	Deluxe 12" kit	spring scale, tube, scraper, case	\$ 185.00	1	\$ 185.00
TOTAL FOR MANUAL TOOLS:					\$ 329.00
TOTALS, WX STATION 1:					
WX STATION 2, LOCAL ONLY SETUP:					\$ 3,365.70
WX STATION 2, CELLULAR SETUP:					\$ 3,988.70

Table 4 of 4: Summary of all costs for all different options:

FINAL SUMMARY: OPTIONS AND COSTS:					
Wx Station 1		Wx Station 2		Fixed cost for both stations	Total Cost
Radio	\$ 5,363.10	Local	\$ 3,365.70	\$ 2,846.00	\$ 11,574.80
		Cell	\$ 3,988.70		\$ 12,197.80
Satellite	\$ 7,348.10	Local	\$ 3,365.70	\$ 2,846.00	\$ 13,559.80
		Cell	\$ 3,988.70		\$ 14,182.80

3.4 Forecasting

3.4.1 Permit Area Daily Forecast of Snow, Weather, and Avalanche Conditions

Instructors and students will have their own fieldbook and will participate in morning meetings. As a group the students will fill out an AM Forecast Form. Instructors will conduct a separate meeting to discuss hazards and plans for the day and facilitate the students' morning meeting.

3.4.2 Identify Data Needed to Improve the Forecast During Each Operational Day

Instructors and students will document daily observations in their personal fieldbook. Each morning students will collect weather data from the hut weather station. Full profiles shall be conducted at each study site on each course that goes to the hut, if feasible (given avalanche, weather and group skill level allows). Additional observations like test profiles and observed avalanches will be recorded.

3.4.3 Daily Forecast Assessment

Each student will participate in a daily debrief and update their personal fieldbook. As a group the students will fill out a PM Debrief Form. If student groups split up during the day, an exchange of information will occur at the end of the day between the different groups.

3.4.4 Forecast Zones

Use your data collection plan and run-list to group terrain within the forecast area into common areas and forecast zones.

Figure 3.4.4 Forecast Zones

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Descriptor	Mile 1 of hut trail	Across from hut, downslope of Mt. Zion	Adjacent/ below hut , downslope of Peak 12,156	Skiers left of hut, downslope of Buckeye Peak	Across Buckeye drainage, downslope of Peak 12,106
Size	.15km ²	1.38km ²	1.83km ²	1.32km ²	2.3km ²
Terrain Ch. (Elevation/aspect)	BTL	ATL-BTL N, E	ATL-BTL E, S	ATL-BTL E, S	ATL-BTL W
Study Plots		Study Pit 1	Study Pits 2, 3	Study Pits 4, 6	Study Pit 5

Wx. Stations			Wx Station 2		Wx Station 1
Landing Zones		LZ 2	LZ1, LZ3		LZ4
Runs by color	Trail	3G, 1O	1G, 3Y, 1O	2Y, 2O, 3R	2Y, 1O
Run Names		"Home Run" "Sourdough Starter" "Tango Trees" "Gully of Doom"	"Green Dream" "Breakfast Run" "Sangree's Chute" "Saddle up" "Sunburn glade"	"Buckeye W Traverse" "White Gold" "Boyfriend's Last Run" "Creamy Facets" "Mine Shaft gully" "Buckeye Bridge Cornice" "Roger's Spring Date" "Messed Breeches"	"One Eyed Willy" "Westward Ho" "Jabroni's Jolly"

3.5 Communication

3.5.1 Pre-Course Orientation Video

Create a pre-course orientation video (less than 5 minutes in duration) for student participants

Video: <https://vimeo.com/311028755>

3.5.1.1 Overview of the Buckeye Gulch area

See *video*. The field location of this course is Buckeye Gulch, located in the Northern Sawatch mountains a few miles north of Leadville. During the week long course, students and faculty will be staying in the Sangree M. Froelicher Hut owned and operated by 10th Mountain Division Hut Association. Students should expect a 2 hour hike to the hut, which provides 15 beds and a unique 600 square foot area, known as the Alpine Resource Center, with its own heat stove, and a comfortable reading, study, and seminar area all on the lower level of the hut. See *Section 3.2.1 for more details about the Buckeye Gulch area*.

3.5.1.2 Overview of basic safety practices while on course

See *video*. *Link in Section 3.5.1.*

- Each student must travel with all required safety equipment at all times when leaving more than 150 ft from the hut. The safety equipment consists of a modern 3-antenna beacon, avalanche probe (minimum length of 270), avalanche shovel, and personal gear repair kit.
 - Students are not allowed to travel alone, and must stay with a group
 - Prior to touring each day, instructors will send travel plans to the Course Monitor, the point of contact at the college, and check in and out of the field
 - When touring, group leaders will check in with other groups two times a day at the predetermined times of 11am and 3pm, or more as deemed necessary. Instructors will leave radios on during the tour, so as to be available at any time.
-

3.5.1.3 Required Safety Equipment

See *video*. *Link in Section 3.5.1.*

- Beacon, probe, and shovel
 - VHF radio
 - Rescue sled
 - Ski rope/cordelette
 - Guide tarp
 - First aid kit
 - Repair kit
 - GPS enabled device
 - Charged cell phone
 - Backup battery or charging device
 - Maps
 - Extra avalanche beacon and batteries
 - See section 3.2.2.2 for full gear list
-

3.5.1.4 Other key information for a course participant prior to going into the field

See video. *Link in Section 3.5.1.* In addition, prior to the field session, each student should consider other items they may need during the week long course such as:

- Cell phone
- Extra layers
- Toiletries
- Food
- Water
- Snow study kit
- Map
- Compass
- Altimeter

Additional resources such as rescue gear will be stored at the hut.

3.6 Project Presentation

3.6.1 Present a summary of your work to the SC Outdoor Studies faculty and administrators. *Project Presentation* will be delivered on January 14, 2019 at 9:00am to the Outdoor Studies administrators and faculty of Sawatch College. Each member of the respondent team will be responsible for presenting a portion of that team's project.

4.0 Section 6- Timeline for Completion of Work

4.1 Deliverables 3.4 *Forecasting* are due each day during the project on-site research period 12/10 - 12/15/2018 unless otherwise indicated by requestor.

4.2 All other Deliverables are due no later than January 13, 2019 at midnight. Final project responses will be uploaded to a Google Drive folder provided indicated by the requestor.

4.3 Item 3.6.1 *Project Presentation* will be delivered on January 14, 2019 at 9:00am to the Outdoor Studies administrators and faculty of Sawatch College. Each member of the respondent team will be responsible for presenting a portion of that team's project.