



# Design, Construction and Maintenance of Nordic Ski Trails

By  
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“Discover Norwich”  
Norwich Historical Society

February 22, 2024

# Personal Background John Morton

- Middlebury College Ski Team
- U.S. Army Biathlon Training Center, Fort Richardson, AK
- U.S. Biathlon Team ('72 Sapporo and '76 Innsbruck Winter Olympics, five Biathlon World Championships)
- Head Coach of Men's Skiing at Dartmouth College
- Morton Trails, LLC. (over thirty years - more than 250 trail projects in 23 states and four foreign countries)



# Stages of Recreational Trail Development

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- Conceptual design and layout
- Cutting and Clearing
- Construction
- Finishing
- On-going Maintenance





# Conceptual Design

## Major Trail Objectives

- Out-the-door access to the natural world
- Convenient, off-road access to desirable destinations
- Convenient linkages to off-site trails
- Event venues



# More Specific Trail Considerations

- What are the landowner's objectives?
- Be clear regarding the available property
- Identify the significant natural features and potential destinations
- Most outdoor enthusiasts prefer a loop, rather than an out-and-back trail
  - One-way traffic is preferable for skiing and mountain biking



# Potential Users and Trail Based Activities

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- Who are the intended trail users? School children? Retirement community residents? Elite, competitive athletes?
- What activities will be welcomed? Walking, hiking, trail running, cross-country skiing, snowshoeing, fat tire biking, mountain biking, horseback riding, disc golf...
- Will the trails be used for casual, unorganized recreation only, or competitions and community events as well?



# Trail Design Tips

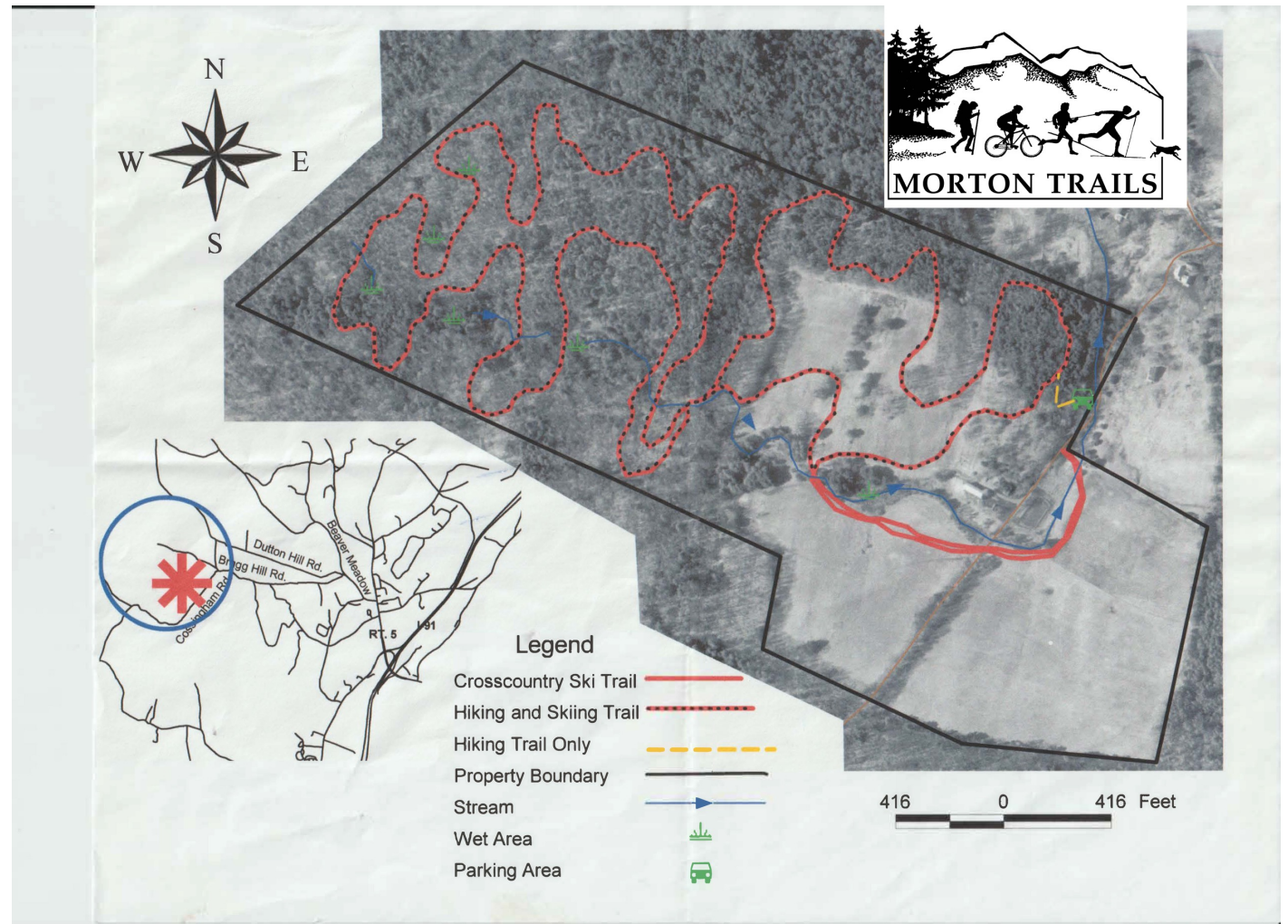
Deal with the most challenging aspects of the property/topography first: stream crossings, ledge outcroppings.

Then focus on elevation changes:

- Climbs should be manageable, ideally broken by sections of traverse or short descents. Avoid long, straight climbs that allow participants to see how far they have to go.
- Descents should be fun, worth the effort of the climb.

Try to ignore vegetation; dense brush, thickets, fallen trees, all of which can be dealt with relatively easily.

Showcase the property's natural features: boulders, impressive trees, ledge outcroppings, streams, vistas, etc.



# Trail Width

Cut the trail corridor somewhat wider than the desired width of the finished trail:

- Walking, hiking, trail running, mountain biking +/- 4'
- Two-way pedestrian traffic +/- 8'
- Cross-country skiing (classic lane and skating lane) minimum 12'-14'

For cross-country skiing open the trail corridor wide enough to give the excavator room to work without skinning the remaining trees bordering the finished trail.

Also, for cross-country skiing, snowshoeing and fat tire biking, cut the corridor wide enough to open the forest canopy so that the snow actually reaches the trail.

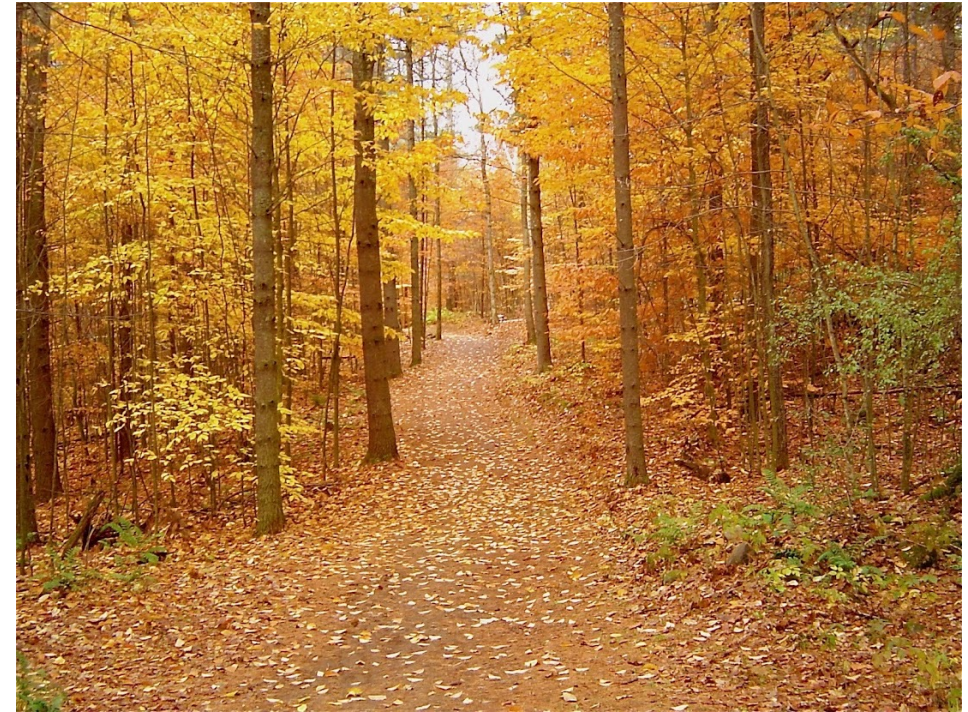




# Cutting and Clearing

Coordinate with consulting forester or the forest management plan regarding which trees to cut for the trail.

- If the forest has been recently thinned, avoid cutting mature, healthy trees where possible. Aesthetics are important to a finished trail. Healthy, majestic or unique trees add to the participant's enjoyment.
- If forest is overdue for a prescribed thinning, it may be preferable to thread the proposed trail through openings created by the harvest of large, mature trees.
- Mature hemlock, spruce and fir bordering the trail, although scenic, can keep snow from reaching the trail surface.



# Existing Woods Roads and Trails

Make use of existing logging roads and skid trails only when it advances or contributes to the recreational trail plan.

Don't follow a marginal woods road, skid trail, or power line simply because it's already there if it degrades the trail concept.



# Construction

Contemporary recreational trails are most effectively constructed by medium-sized excavators.

- Remove stumps, roots and boulders from the trail corridor.
- Install culverts or bridges at stream crossings.
- Create gentle swales on the uphill side of the trail to direct water to culverts.





# Construction

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- Cut and fill trail across sidehills where necessary.
- Slightly crown the center of the trail to shed moisture.
- Bank descending turns, especially for skiing and biking.
- Where necessary, mellow out abrupt terrain changes of the trail route. When finished, a good cross-country ski trail should be able to accommodate a four-wheel drive pick-up truck.



# Finishing

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- Well excavated trails are often ready to be seeded, but if not, a Harley rake creates a relatively smooth surface.
- Seed with Conservation Mix and mulch with hay for best germination results.



# Finishing

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- Where there may be too much shade for growing grass, spread wood chips.
- Limb overhanging branches and saplings, especially those that will obstruct the trail when laden with snow.



# Finishing

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- Install clear, distinctive trail markers and signs.
- Consider posting simple, colorful maps and trail information in kiosks at trailheads.





# Ongoing Maintenance

- Mow the trail as needed during the summer.
- Remove fallen branches and occasional uprooted trees as necessary, especially following severe storms.
- Check and clear out culverts spring and fall.
- Cut back encroaching brush and overhanging branches from trail edges as necessary.
- Trail users are almost always willing to volunteer to help with trail maintenance.

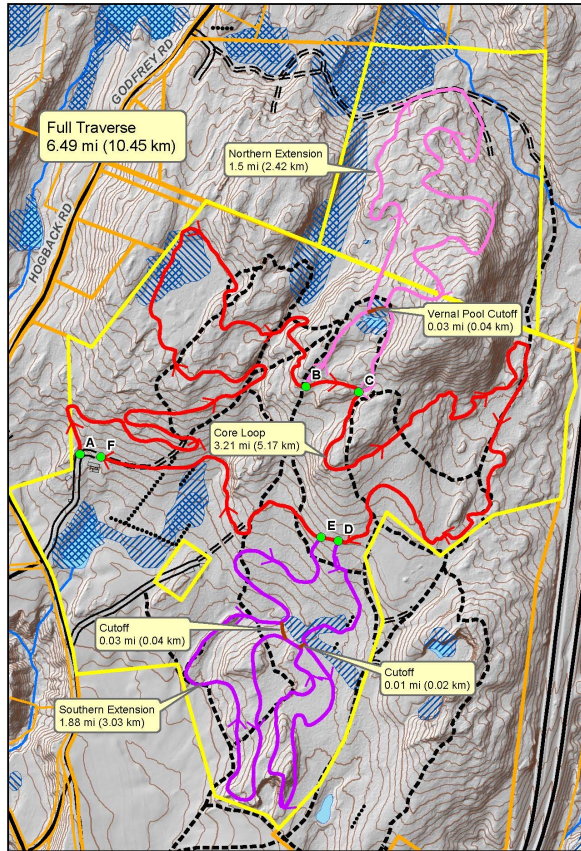




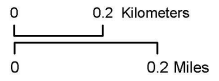
# Trails Thetford, Vt - Proposed Trails

**CORE LOOP,  
NORTHERN EXTENSION,  
SOUTHERN EXTENSION,  
FLAGGED**

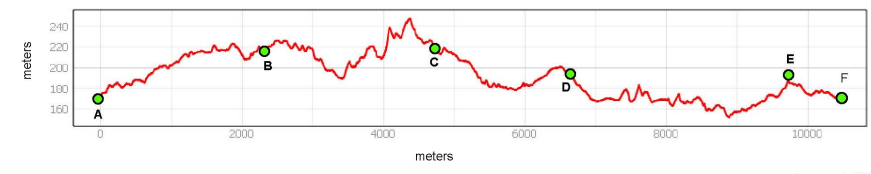
Map compiled for Morton Trails by Stonehouse Min Mapping - VCCIMA Open Cascade, Packed, some softoff. Elevation Data: Provided by Birnie Sands - revesed. Proposed Trails: Morton Trails, Field work, Air photo, USDA MAP 2018. Buildings, Woods made: interpreted from Lidar and orthophoto.



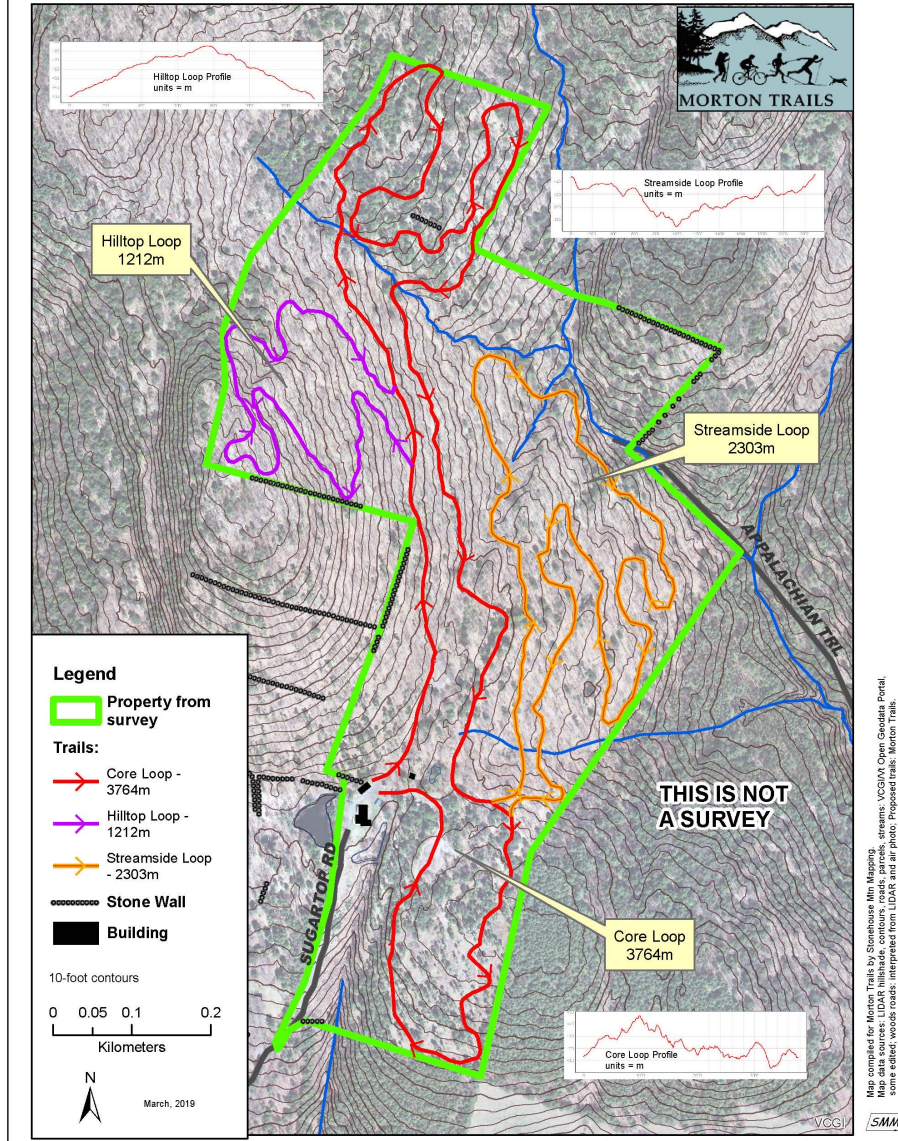
- Legend**
- Proposed Trails:
- Core Loop
  - Northern Extension
  - Southern Extension
  - Cutoff
- ▭ Neighboring Properties
  - ▭ Woods Roads, etc.
  - ▭ Driveway
  - ▭ Possible Stone Wall
  - ▭ Buildings
  - ▨ VSWI Wetlands Class Layer
  - ▨ VSWI Wetlands Advisory Layer
- Contours:
- 10-ft
  - 50-ft



Course Profile



# Trails Norwich, Vermont





# Conclusion

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- Recreational trail use has increased dramatically in recent years, especially during the pandemic.
- Successful trails range from very modest paths through private woodlots to expensive, highly engineered public trails linking communities.
- To quote Stephen Covey, “Start with the end in mind”. What is the objective of the trail, what property is available, and who will be the intended users?
- Questions?

