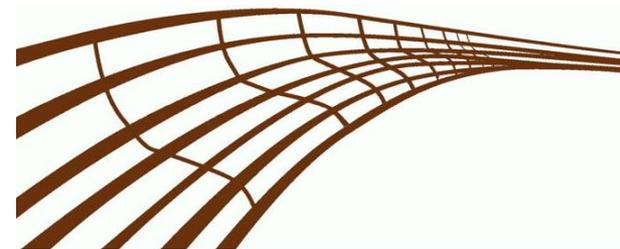
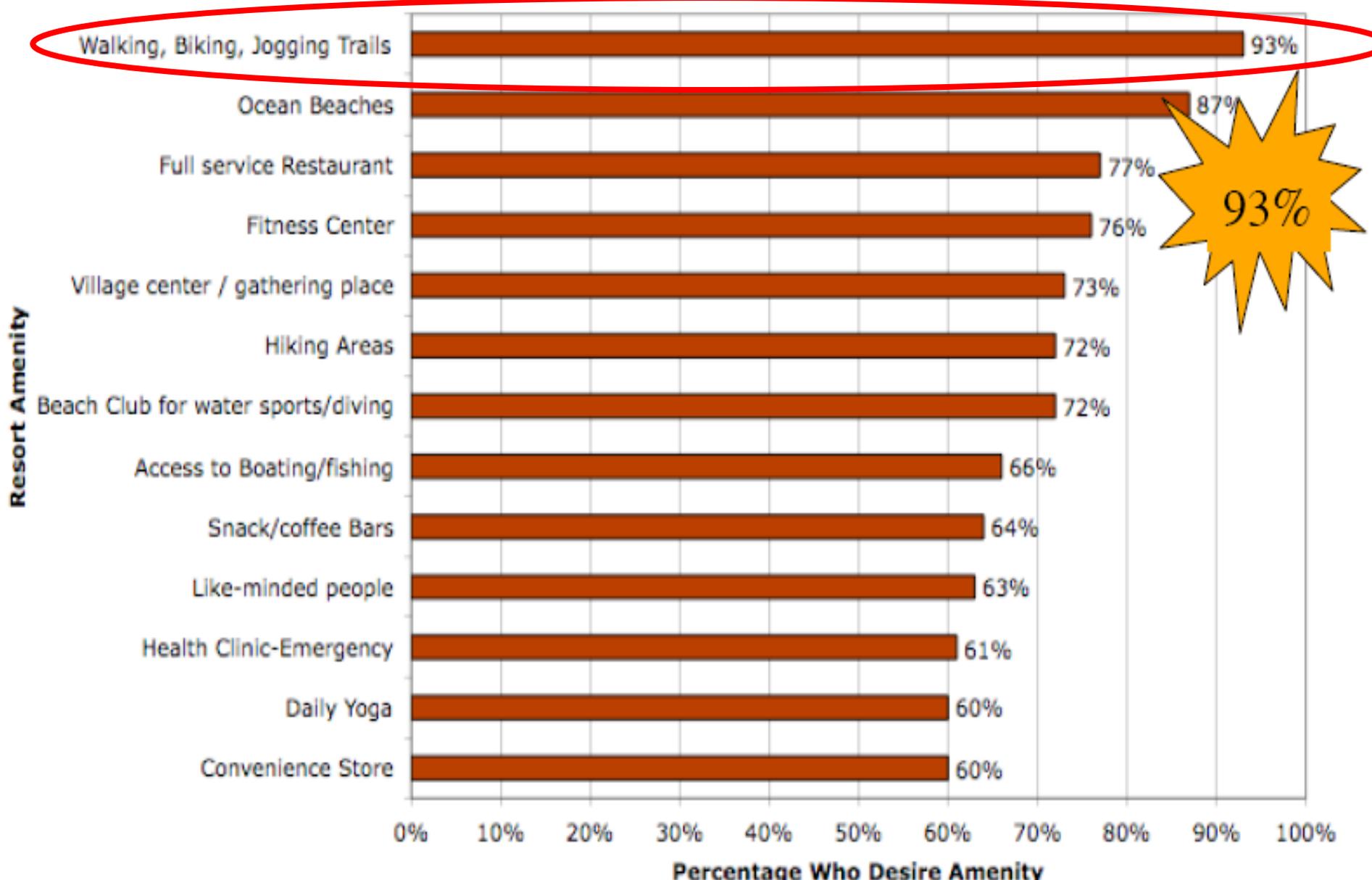


Design and Build a Trail Worth Traveling To!



Resort Amenity Popularity Comparison 2009



Source: Brook Warrick American Lives, 2009
1000 responses from U.S. Prospects for a Caribbean resort

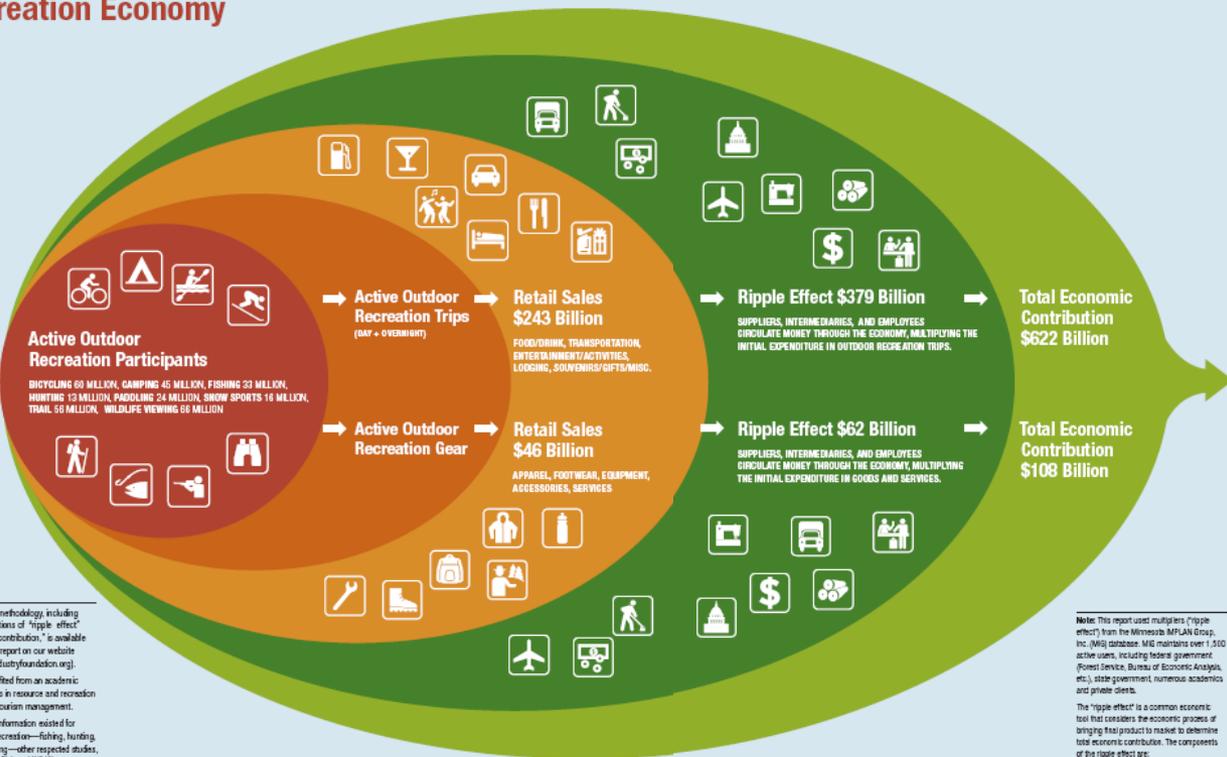
The Active Outdoor Recreation Economy

A \$730 BILLION ANNUAL CONTRIBUTION TO THE U.S. ECONOMY



Meet the \$730 Billion Active Outdoor Recreation Economy

THE ECONOMY 6

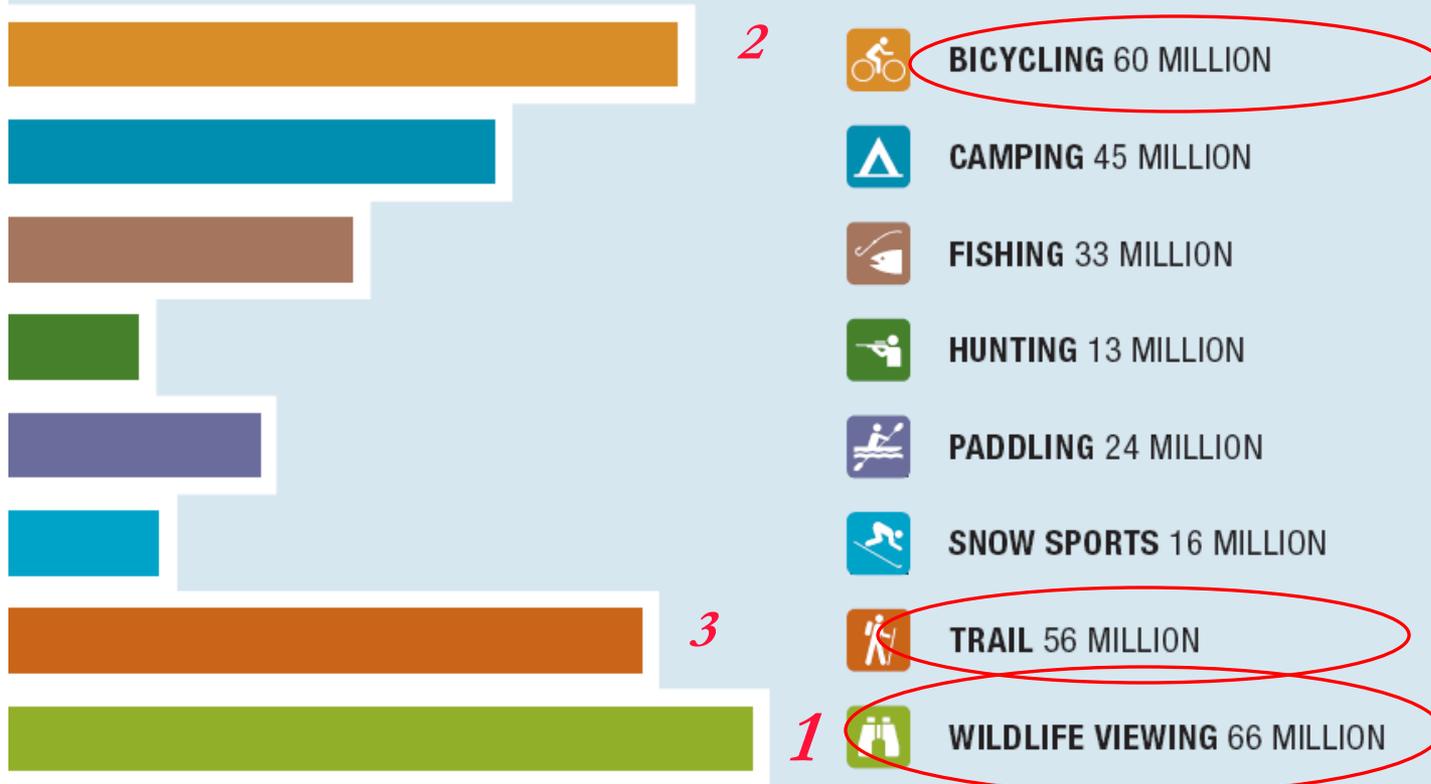


Note: Detailed methodology, including additional definitions of "ripple effect" and "economic contribution," is available in the technical report on our website (www.outdoorindustryfoundation.org). This report benefited from an academic review by leaders in resource and recreation economics and tourism management. Because great information existed for wildlife-based recreation—fishing, hunting, and wildlife viewing—other respected studies, such as the U.S. Fish and Wildlife report were used to gauge these contributions.

Note: This report used multipliers ("ripple effect") from the Minnesota MPLAN Group, Inc. (MGI) database. MGI maintains over 1,500 active users, including federal government (Forest Service, Bureau of Economic Analysis, etc.), state government, numerous academics and private clients. The "ripple effect" is a common economic tool that considers the economic process of turning their product to market to determine total economic contribution. The components of the ripple effect are:
 • Direct effect: the initial purchase made by the consumer
 • Induced effect: sales in one industry affect the various other industries that provide supplies and support
 • Multiplier effect: wages and salaries paid by the directly and indirectly impacted industries circulate through the economy
 • Leverage: occur at each component of the ripple effect when a business or individual spends money outside of the study region for products or services that are either imported into the study region or consumed outside of the region.

Total National Economic Contribution \$730 Billion

ACTIVE OUTDOOR RECREATION PARTICIPANTS BY THE NUMBERS



★ The number of Americans who participate in bicycling is double the population of Canada.

★ The number of New Englanders who participate in trail-based recreation annually is greater than the combined attendance for all 81 Boston Red Sox home games.³

*181,000,000/300,000,000
Americans use Trails*

The Active Outdoor Recreation Economy
A \$730 BILLION ANNUAL CONTRIBUTION TO THE U.S. ECONOMY

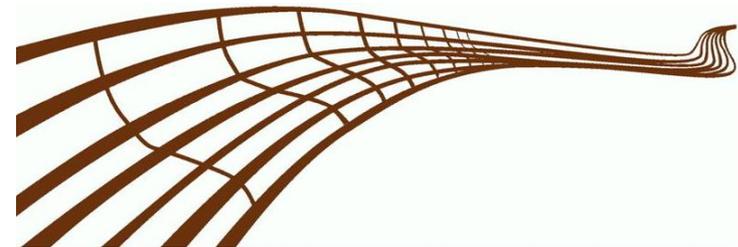




Thus,
It is a
Crime to
Build
Boring
trail!

How might a community
Capture more of the these
people?

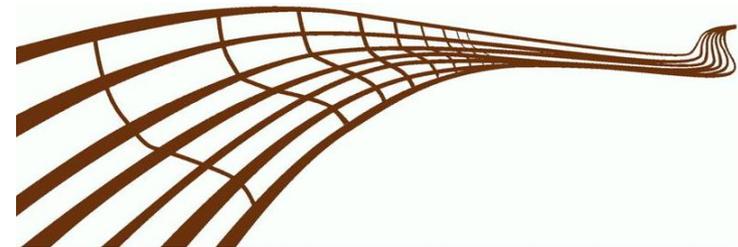
Design and Build a
Trail Worth Traveling To!



How do we design and build a trail worth
Traveling to? **Make it a Delightful
Experience.**

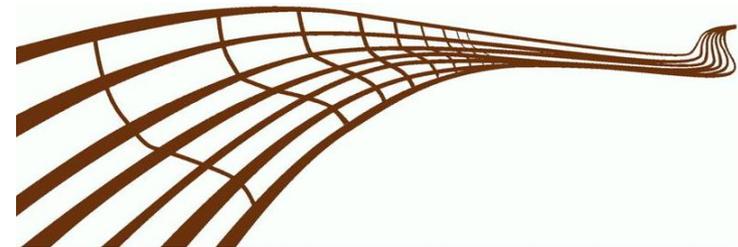
5 Points

- Make it Easy (Grade)
- Move them Physically (Stimulation)
- Move them Emotionally (Stimulation)
- Help them feel Relatively Safe
- Make it Last (Water Management)



5 Elements

- **Make it Easy (Grade)**
- Move them Physically (Stimulation)
- Move them Emotionally (Stimulation)
- Help them feel Relatively Safe
- Make it Last (Water Management)



- Make it Easy (Grade)

Delight verses Drudgery

- 4% Undulating and Meandering
Connector Trail, Auburn, CA

- 15% Straight Trail,
Stevens Trail, Auburn, CA

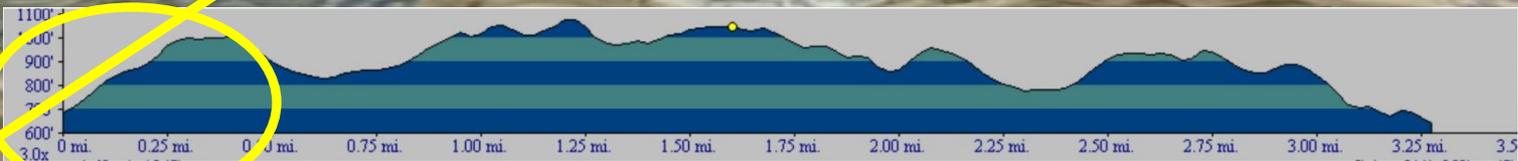


Drudgery

**1st 1/3 mile 17% Grade,
300 Vertical Feet**

© 2007 Sanborn
Image © 2007 DigitalGlobe
© 2007 Europa Technologies

© 2007

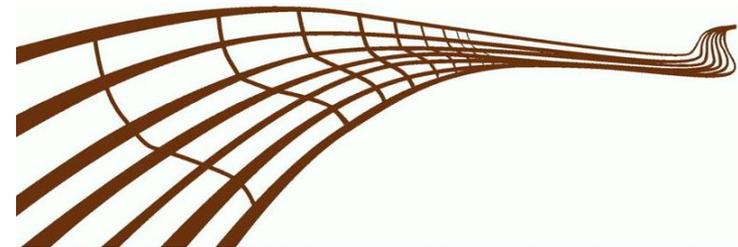
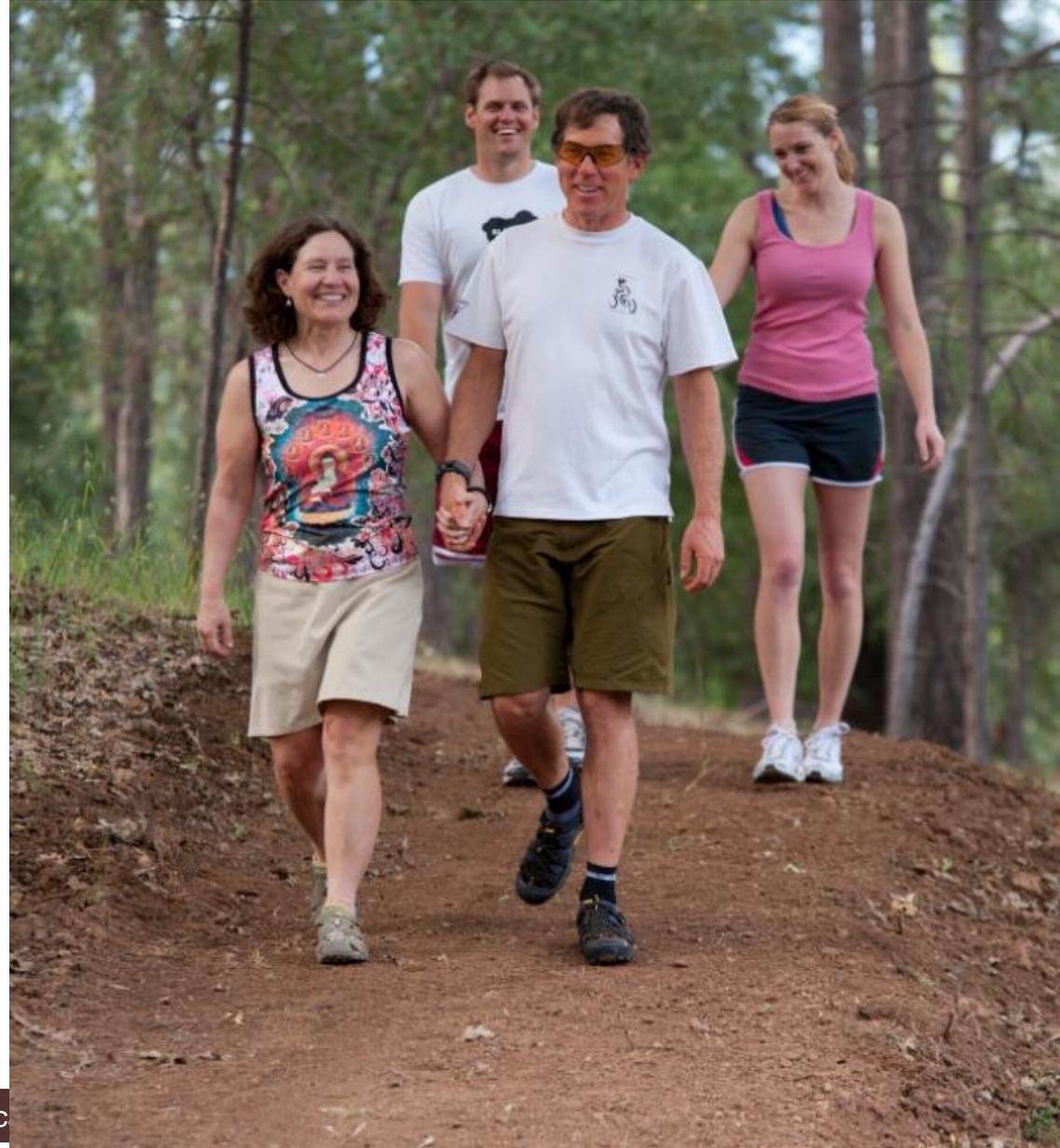


Delight

1st mile 4% grade, 125 Vertical feet
 1st 1/3 mile 17% Grade,
 300 Vertical Feet



Users Experience

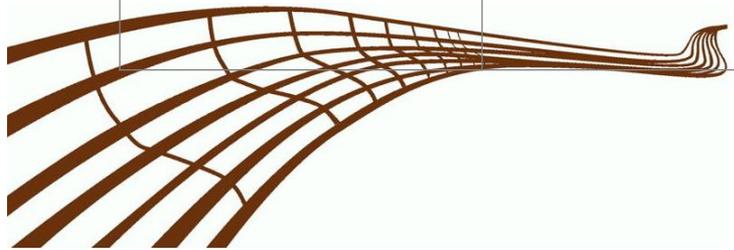


User-Experience for Hiking

The Ascent

Average Grade	Hiking Description	User Experience
0-3% Up	May not be enough to provide fitness demand at full walking speed	Yellow
4-8% Up	Enough grade to get heart going still comfortable for the aged.	Light Green
7- 10% Up	Easier to get heart rate up at a walking speed	Light Green
10- 15% Up	Heavy demand	Yellow
15-20% Up	Hard hiking, not likely talking	Red

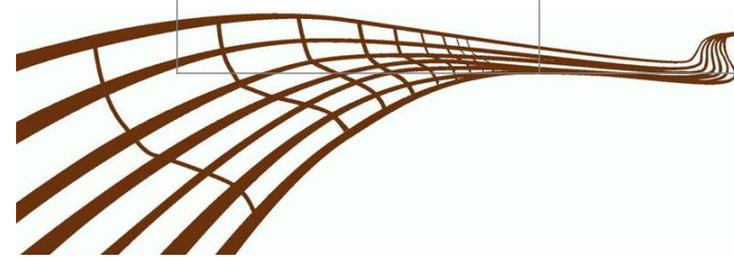
Sweet spot



User-Experience for Hiking

The Descent

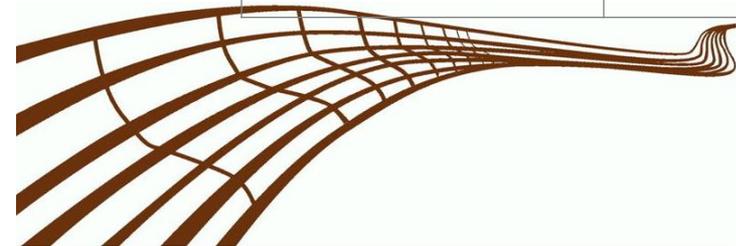
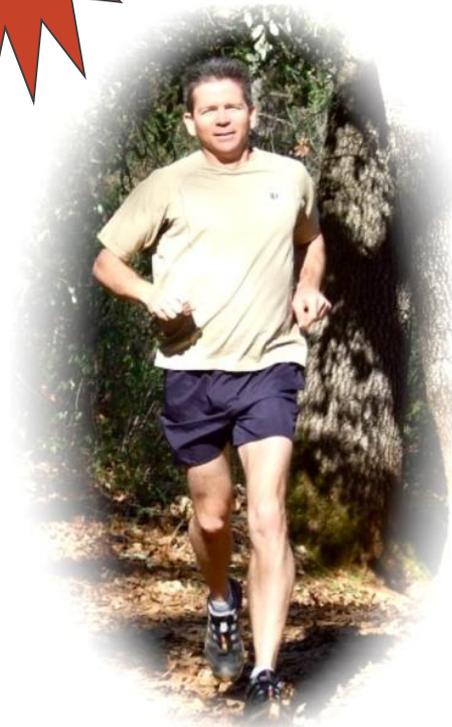
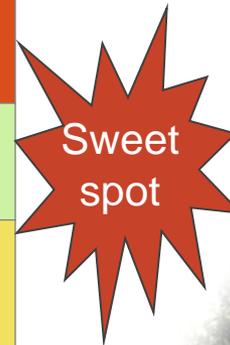
Average Grade	Hiking Description	User Experience
0-3% Down	Fairly restful	Sweet spot
4-8% Down	Boosted walking, some breaking or foot slap	
7- 10% Down	Heavier pounding	
10- 15% Down	Pounding due to braking	
15-20% Down	Small step pounding	



User-Experience for Running

The Ascent

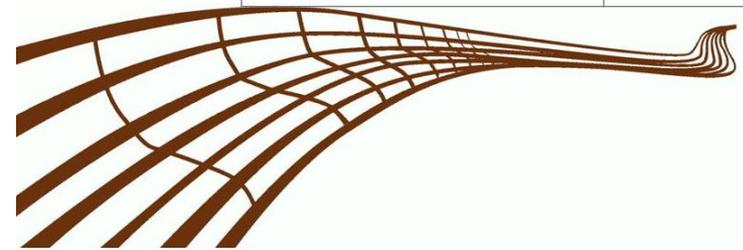
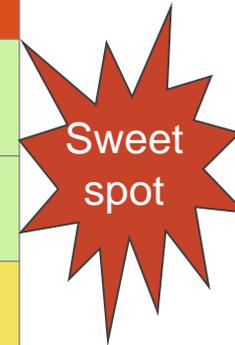
Average Grade	Hiking Description	User Experience
0-3% Up	Full speed, light load, able to run full distance speed	
4-8% Up	Starts to feel some demand but can be ascended at 3/4 speed	
7- 10% Up	Significant slowing toward 10%	
10- 15% Up	Approaches running at a walking pace	
15-20% Up	Walking is just as fast	



User-Experience for Running

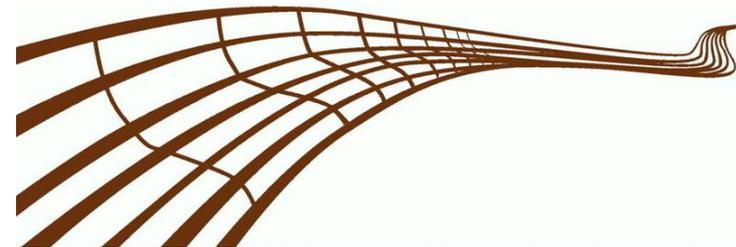
The Descent

Average Grade	Hiking Description	User Experience
0-3% Down	At 3%, a runner can let 'em roll without pounding, turns feel rolly	Light Green
4-8% Down	At 5-6%, sustained, some braking with every step	Light Green
7- 10% Down	Pounding with every step full stride	Yellow
10- 15% Down	Shorter Step Pounding	Orange
15-20% Down	Small Step Pounding	Orange



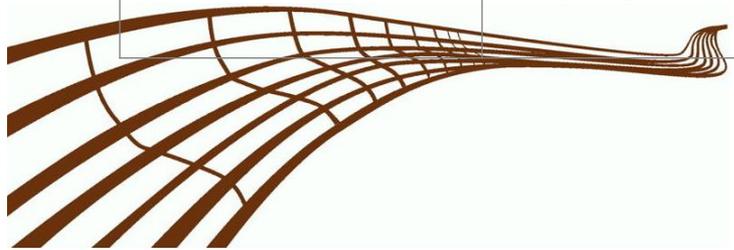
User-Experience for Biking The Ascent

Average Grade	Bicycle Description	User Experience
0-3% Up	Fast efficient climbing,	Delight
4-8% Up	Middle chain ring climbing, Maybe	Light Work
7- 10% Up	shifting to small chain ring, a boring grind	Hard Work
10- 15% Up	Small chain ring, slow climbing, maybe walking, even 12%	Strain
15-20% Up	Small chain ring, Granny gear. Walking the bike may be necessary	Oppressive



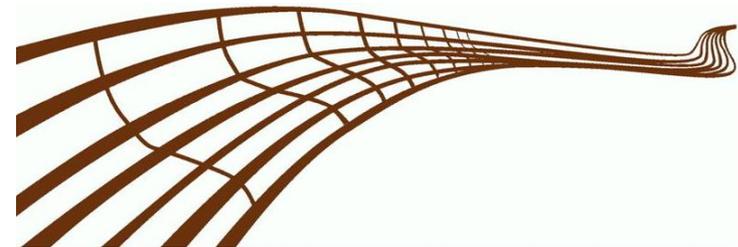
User-Experience for **Bicycling** The Descent

Average Grade	Bicycle Description	User Experience
0-3% Down	Pedaling downhill, without braking, good fitness high, delight, can coast, able to use full traction for turning not braking.	Yipee
4-8% Down	Enough grade to coast, some pedaling, exciting and fast	Exciting
7- 10% Down	Really fun but using up elevation quickly, intermittent braking	Pay Attention
10- 15% Down	Consistent braking, difficult to turn and brake	Hands Hurt
15-20% Down	Heavy continual braking. Can feel like going over bars	Uncomfortable



5 Elements

- Make it Easy (Grade)
- Move them Physically (Stimulation)
- Move them Emotionally (Stimulation)
- Help them feel Relatively Safe
- Make it Last (Water Management)



- Make it Easy (Grade)
- Move them Physically (Stimulation)
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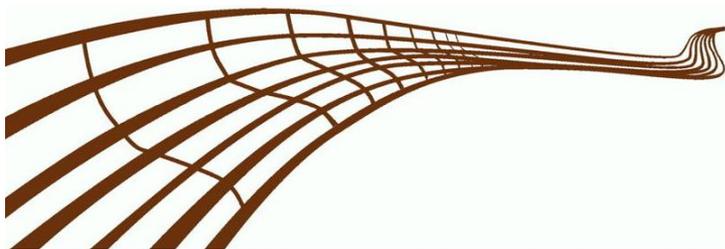
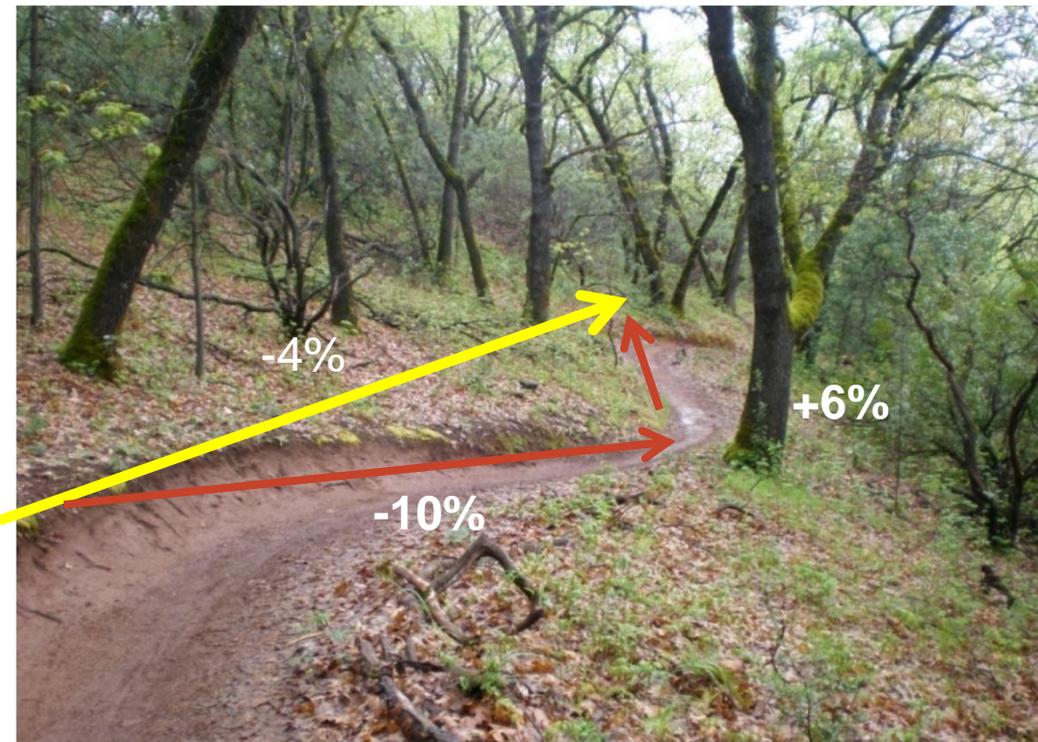
Undulation and Meander



Undulation and Meander

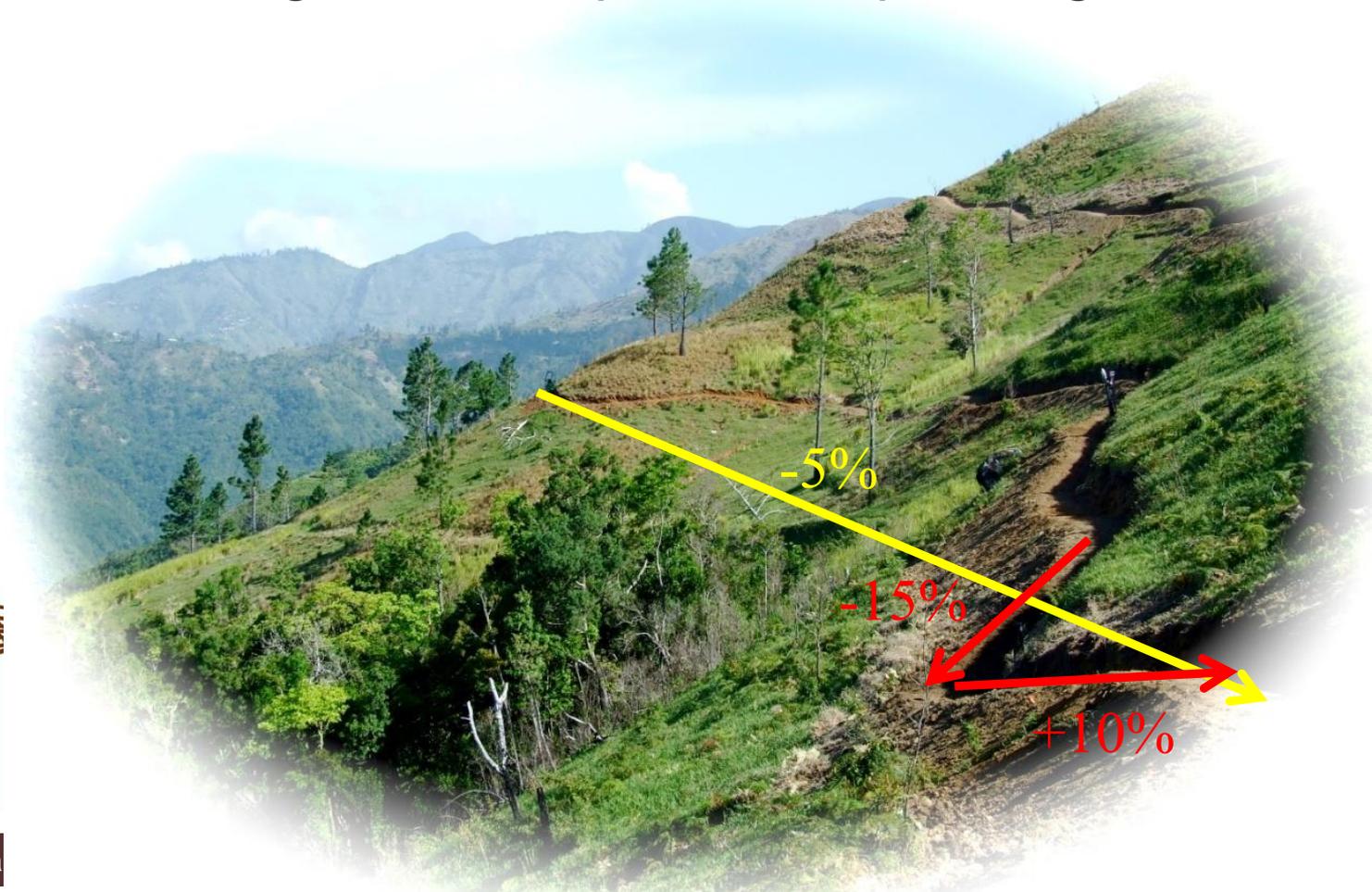
- Keep experience visually changing- Interesting
- Physically constantly changing, optimizing fitness
- Roller coast coaster fun

- Moderate Average Trail Grade 4%
- Aggressive Short Grades Up To 22%



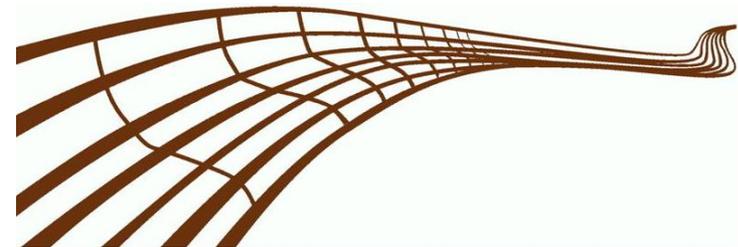
Optimal Climb Grade (My Opinion)

- Below 5% average Grade, up to 15% specific grade.



Minimum / Maximum Design

- Make it Easy (Grade)
- Move them Physically (Stimulation)
- Move them Emotionally (Stimulation)
- Help them feel Relatively Safe
- Make it Last (Water Management)

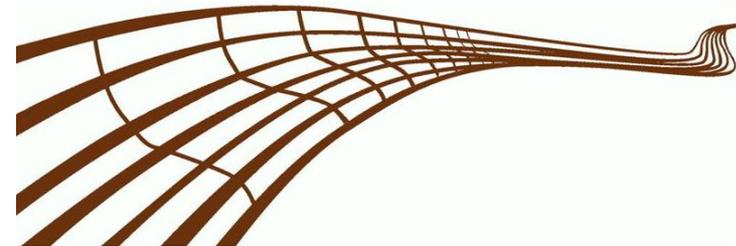


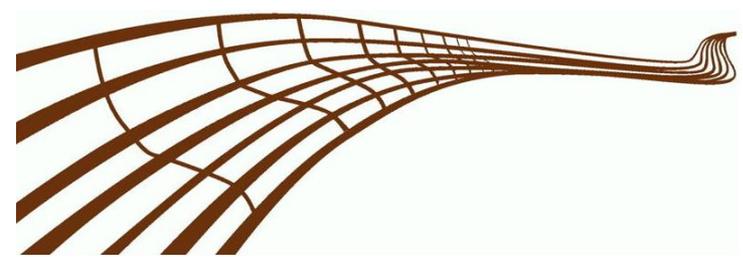
Jamaica



 Trailscape

Auburn Ca



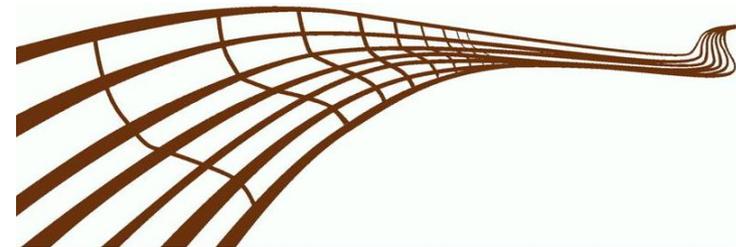


Jamaica Undulation Video

- <http://www.youtube.com/watch?v=zxeRS-RZO8s&context=C4b77017ADvjVQa1PpcFOB BhSfhemq96D4Gru-3hQ6TNfgULeqAUUp://=>



Undulation - Large.m4v



Minimum/Maximum Design

- What it is?
 - **Average Tread Grade**
 - Pushing the grade down as much is reasonable
 - **Short Grades**
 - Pushing the grade as high as reasonable



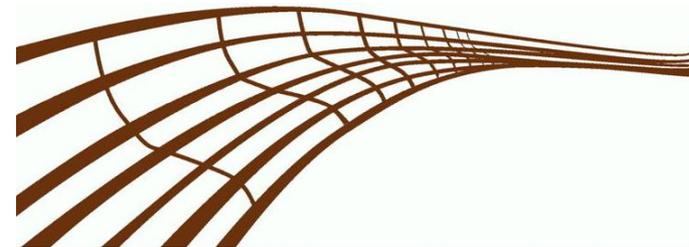
Challenges to the “Minimum/ Maximum Design.”

- Average Trail Grade 4%
 - While designing to minimize average grade, the legs of a switchback can be very close



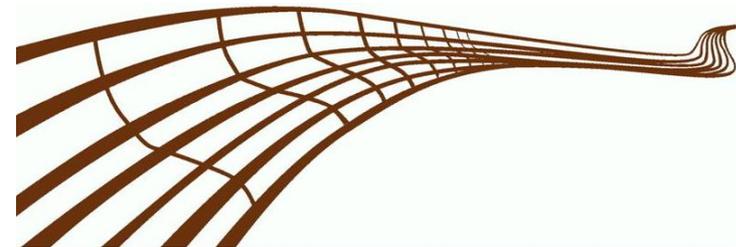
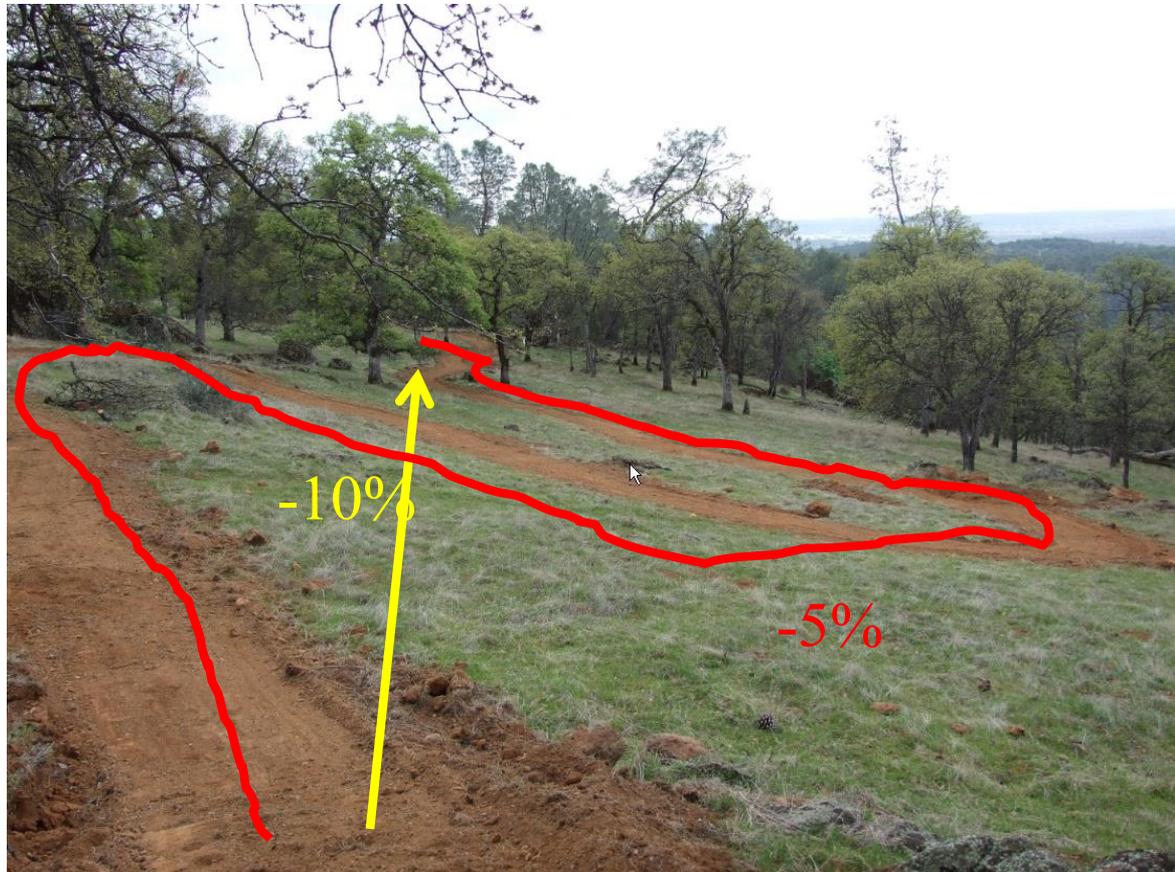
Challenges to the “Minimum/ Maximum Design.”

- Balancing efficiency with healthy undulation and meander.



Challenges to the “Minimum/ Maximum Design.”

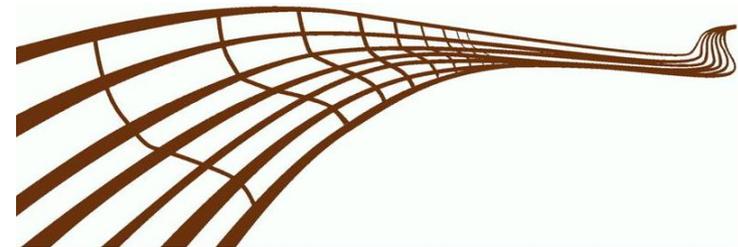
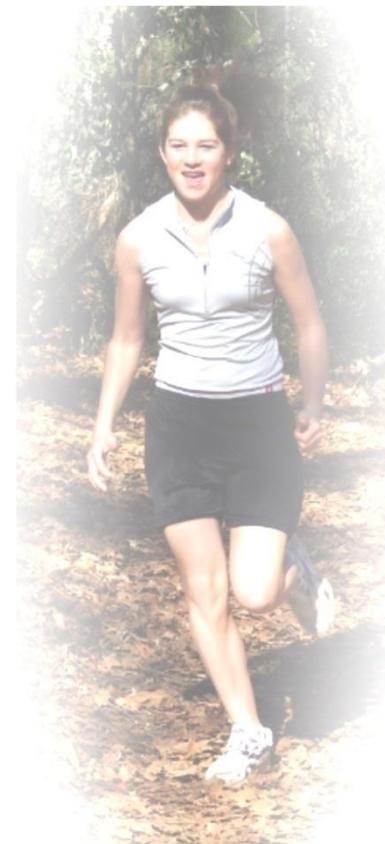
- Longer to get to a summit.
- Balance with available resources. \$
- Value to cost is high, so it is worth pushing for more resources



User Groups that the Minimum/Maximum Design Serves

- Bicyclists
- Runners
- Equestrians
- Hikers

In every group except hikers, greater physical demand can be attained by going slightly faster.

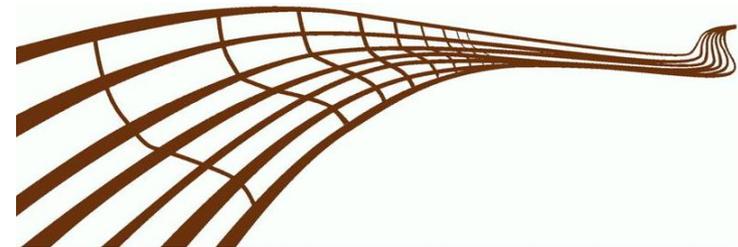


In Slope Turns

- Jamaican Turns 1.15

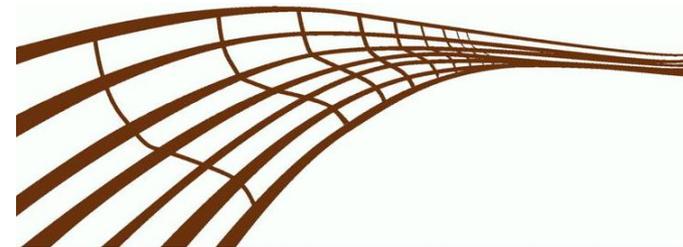


Trailscape Banks and Turns.m4v



Banked Turns

- Steepness of Turn
- Diameter of Turn
- **Shape**
- Drainage



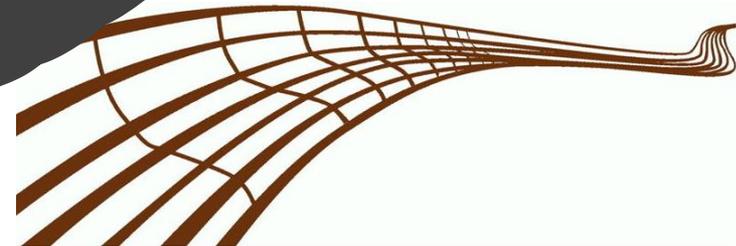
Flat Out Of Turn



Inslope Turns

- Steepness of Turn
- Diameter of Turn
- **Shape**
- **Drainage**

Climb Up To Turn



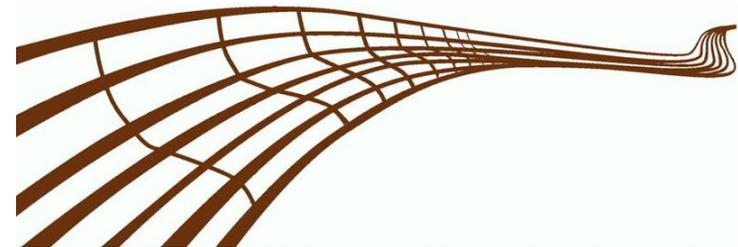
Inslope Turns

- Steepness of Turn
- Diameter of Turn
- Shape
- **Drainage**

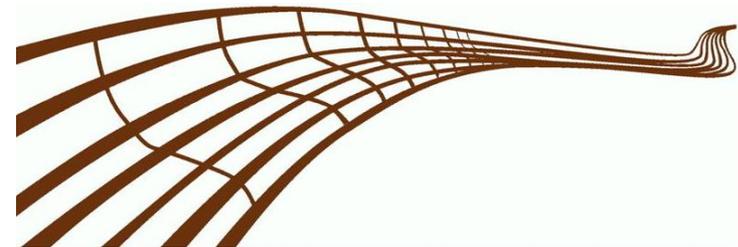


5 Elements

- Make it Easy (Grade)
- Move them Physically (Stimulation)
- **Move them Emotionally (Stimulation)**
- Help them feel Relatively Safe
- Make it Last (Water Management)



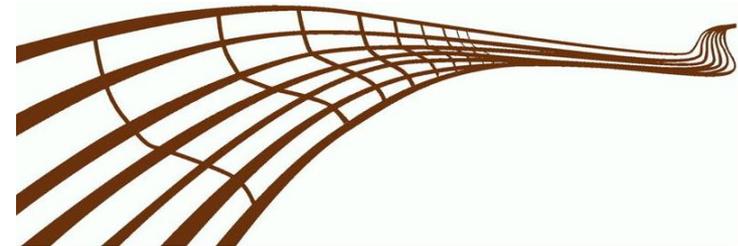
- Make it Easy (Grade)
 - Move them Physically (Stimulation)
 - **Move them Emotionally (Stimulation)**
 - Help them feel Relatively Safe
 - Make it Last (Water Management)
-
- **Guide them to special places**
 - Views, Meditation spots, Benches
 - Guide their eyes: as the trail meanders it guides the user's eyes





5 Elements

- Make it Easy (Grade)
- Move them Physically (Stimulation)
- Move them Emotionally (Stimulation)
- **Help them feel Relatively Safe**
- Make it Last (Water Management)



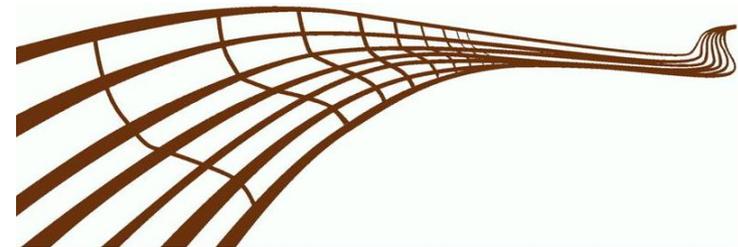
Safety

- Route Trails away from Danger
- Allow for long sight lines appropriate for users
- Clear out fall zones



5 Elements

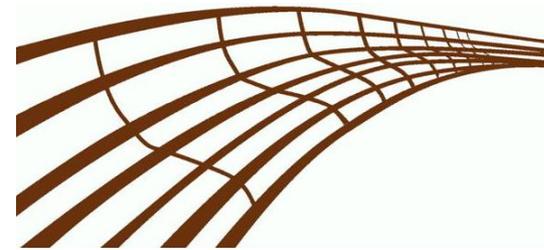
- Make it Easy (Grade)
- Move them Physically (Stimulation)
- Move them Emotionally (Stimulation)
- Help them feel Relatively Safe
- **Make it Last (Water Management)**



Make it Last (Water Management) Trailscape

What allowed the water to damage the trail?

Original Grade

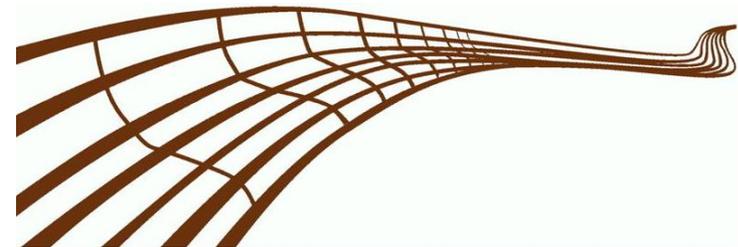


Make it Last (Water Management)



Considerations

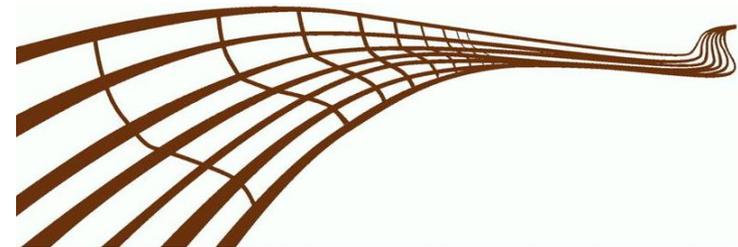
- Walk the area to see when erosion occurs
“In This soils and climate looks like water can flow for 25’ at 12 % before the erosions starts at 6% 45 feet”
- Water flows straight unless forced to change
- When water slow down is drops silt.



Make it Last (Water Management)

Primary Solutions:

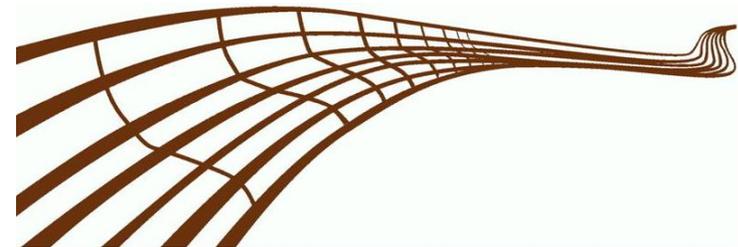
- Keep the overall grade low
- Undulate and Meander the trail to force water off.



Conclusion

- Make it Easy
- Move them Physically
- Move them Emotionally
- Help them feel Relatively Safe
- Make it Last

**Build a Trail
Worth Traveling To!**



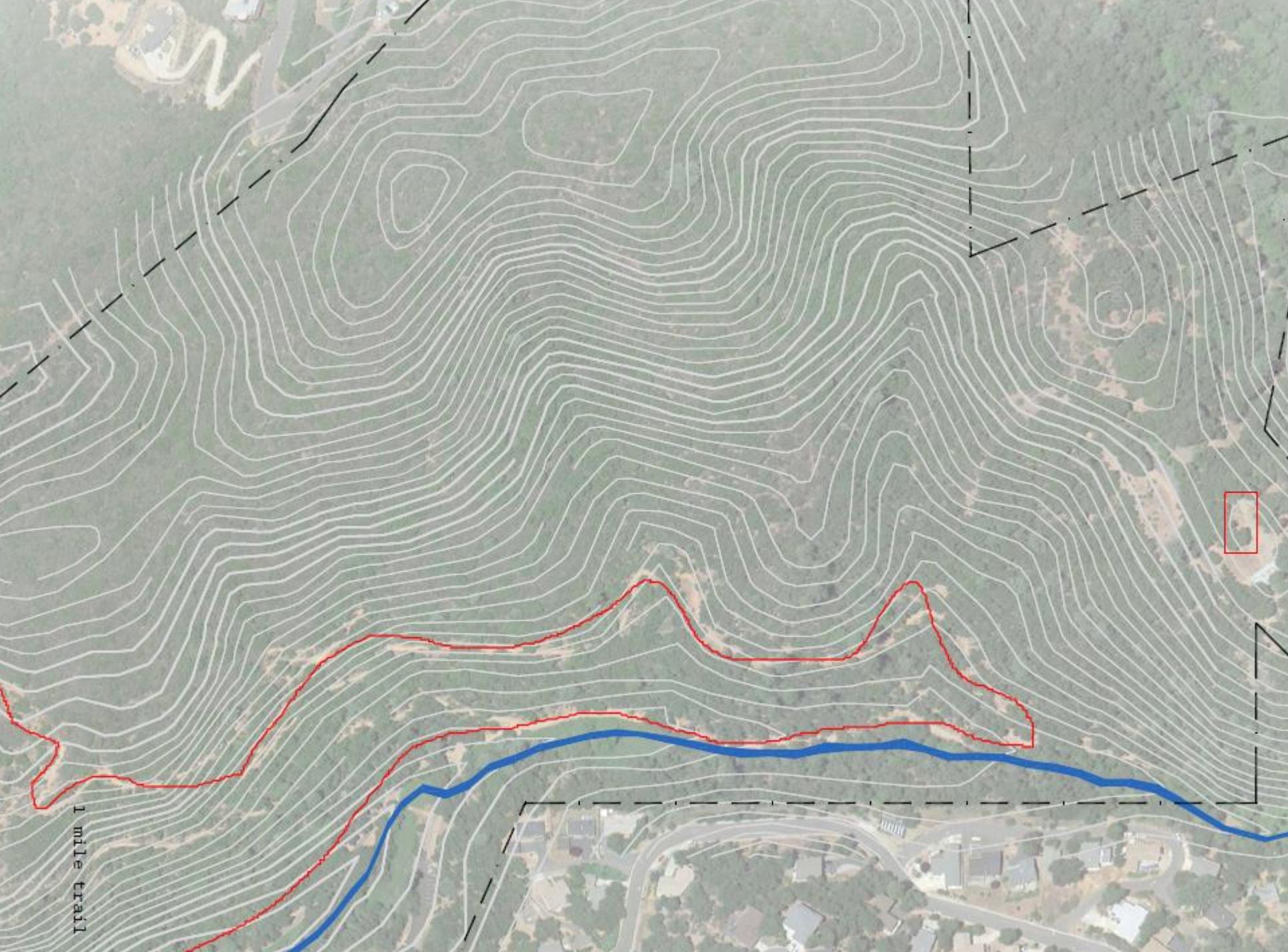


Conclusion

- Make it Easy
- Move them Physically
- Move them Emotionally
- Help them feel Relatively Safe
- Make it Last



Build a Trail Worth Traveling To!



1 mile trail



Search

Search Google Parcel Search (API)

sonora ca Search

Museums in New York, NY

Get Directions History

Sonora, CA 95370

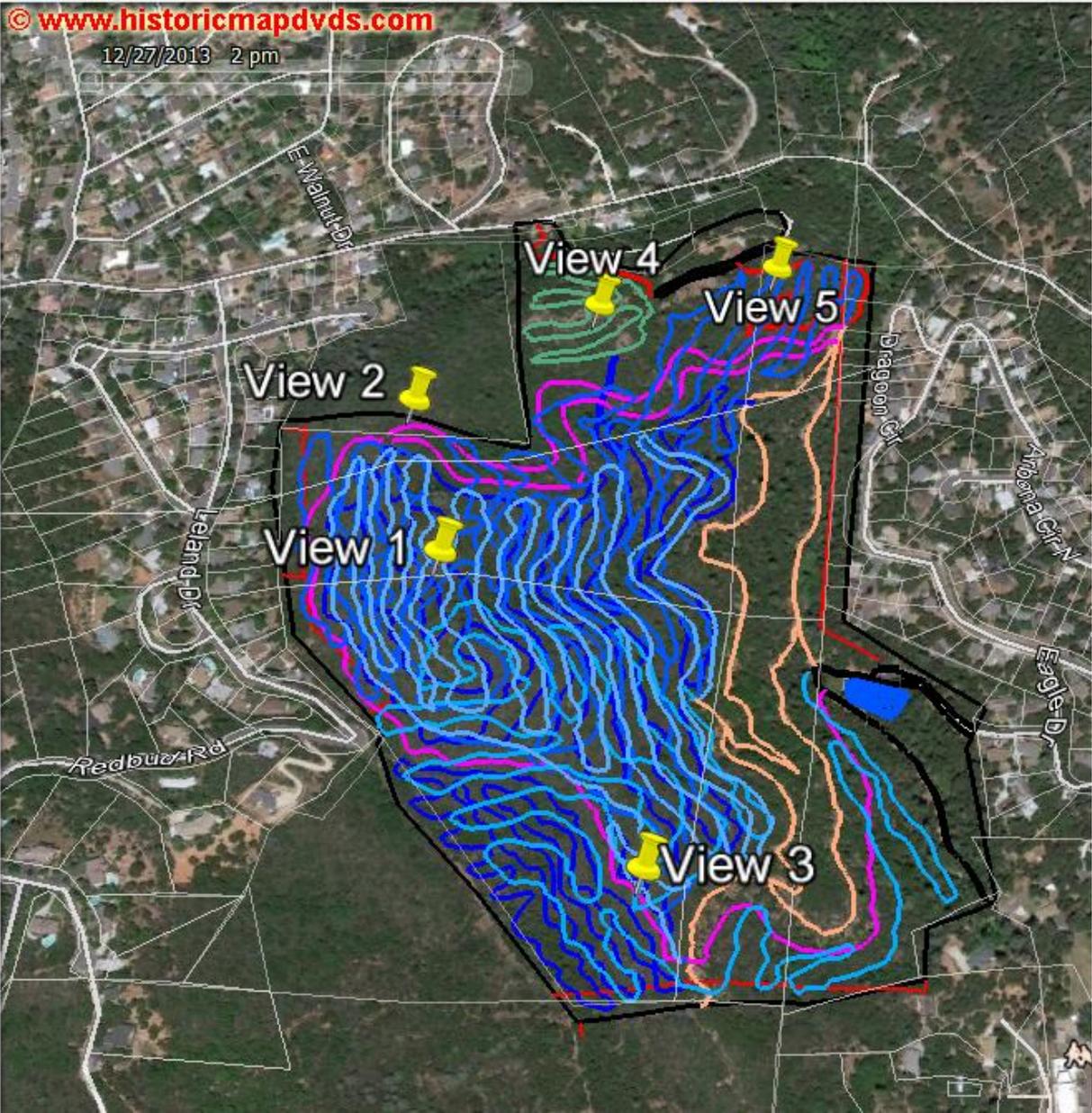
Places

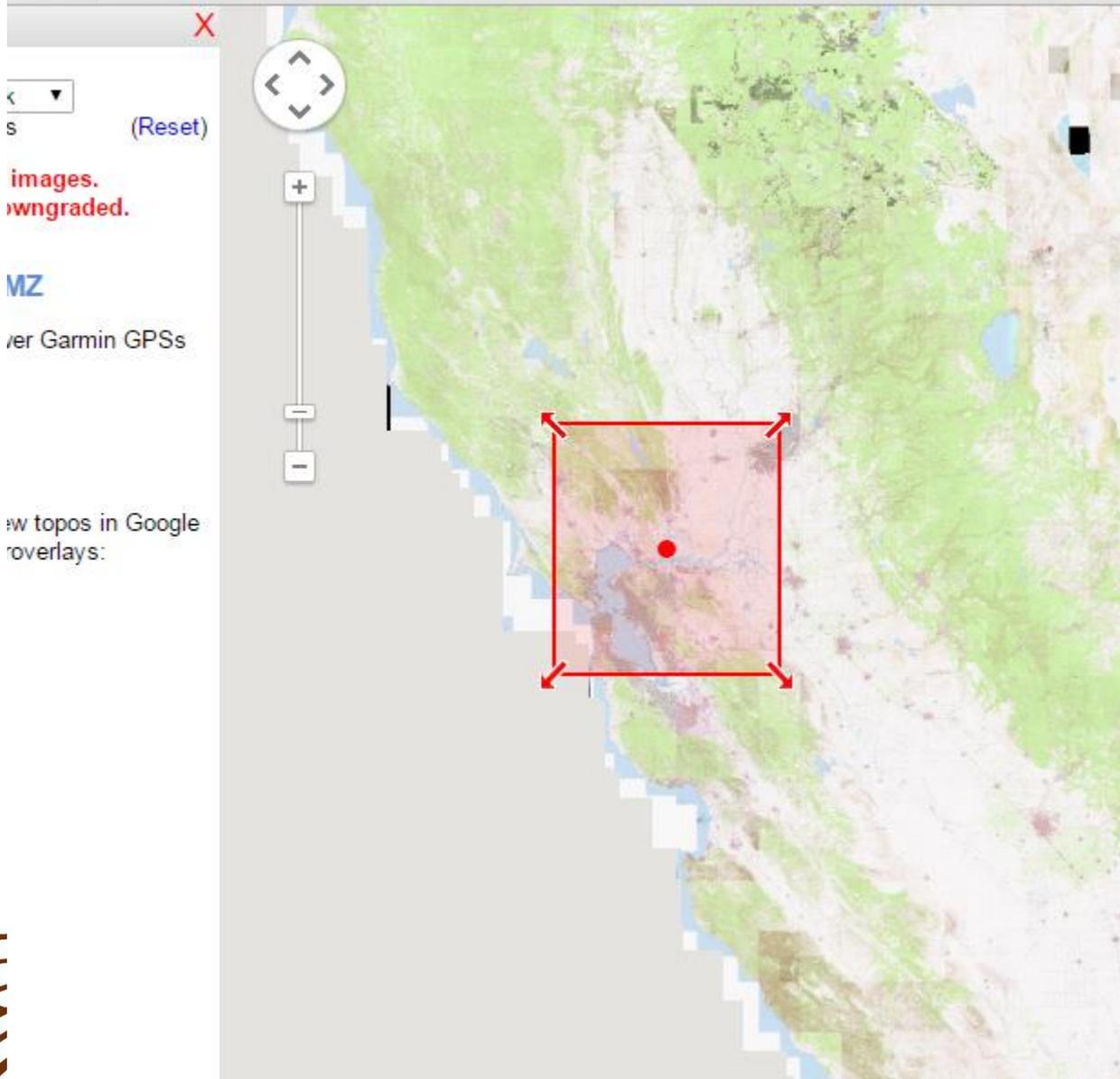
- My Places
- Google Maps
- Bristol pl 3
- CalTopo USGS 7.5' Topos Export (15/16)
- CalTopo USGS 7.5' Topos Export (15/16)
- CalTopo US Forest Service
- 2-0-1
- 2-0-0
- 2-1-0
- 2-1-1
- CalTopo Napa
- CalTopo USGS 7.5' Topos Export (15/16)

Layers

- Primary Database
- Earth Pro (US)

Earth Gallery >>





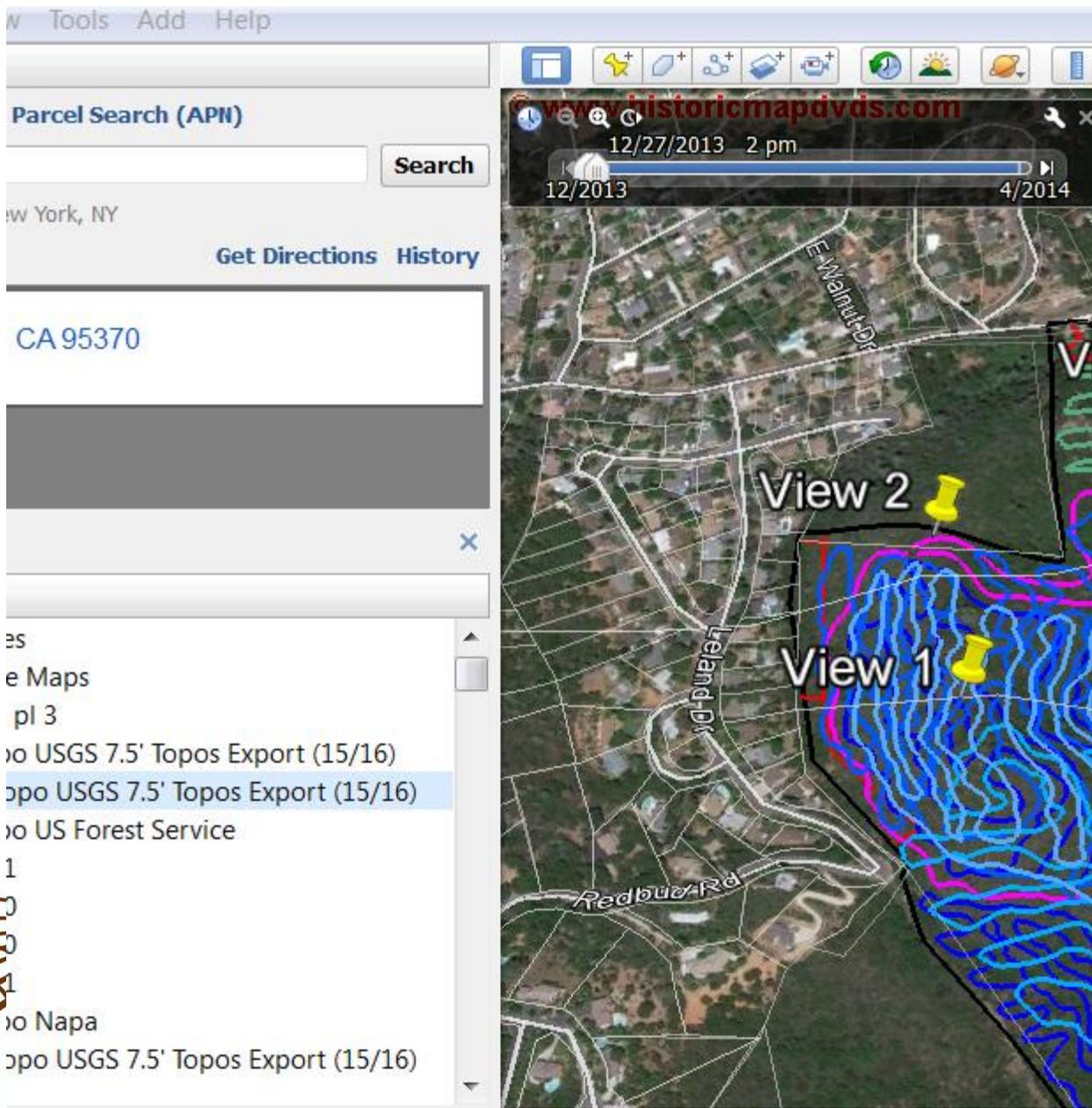
File Tools Add Help

Parcel Search (APN) Search

New York, NY [Get Directions](#) [History](#)

CA 95370

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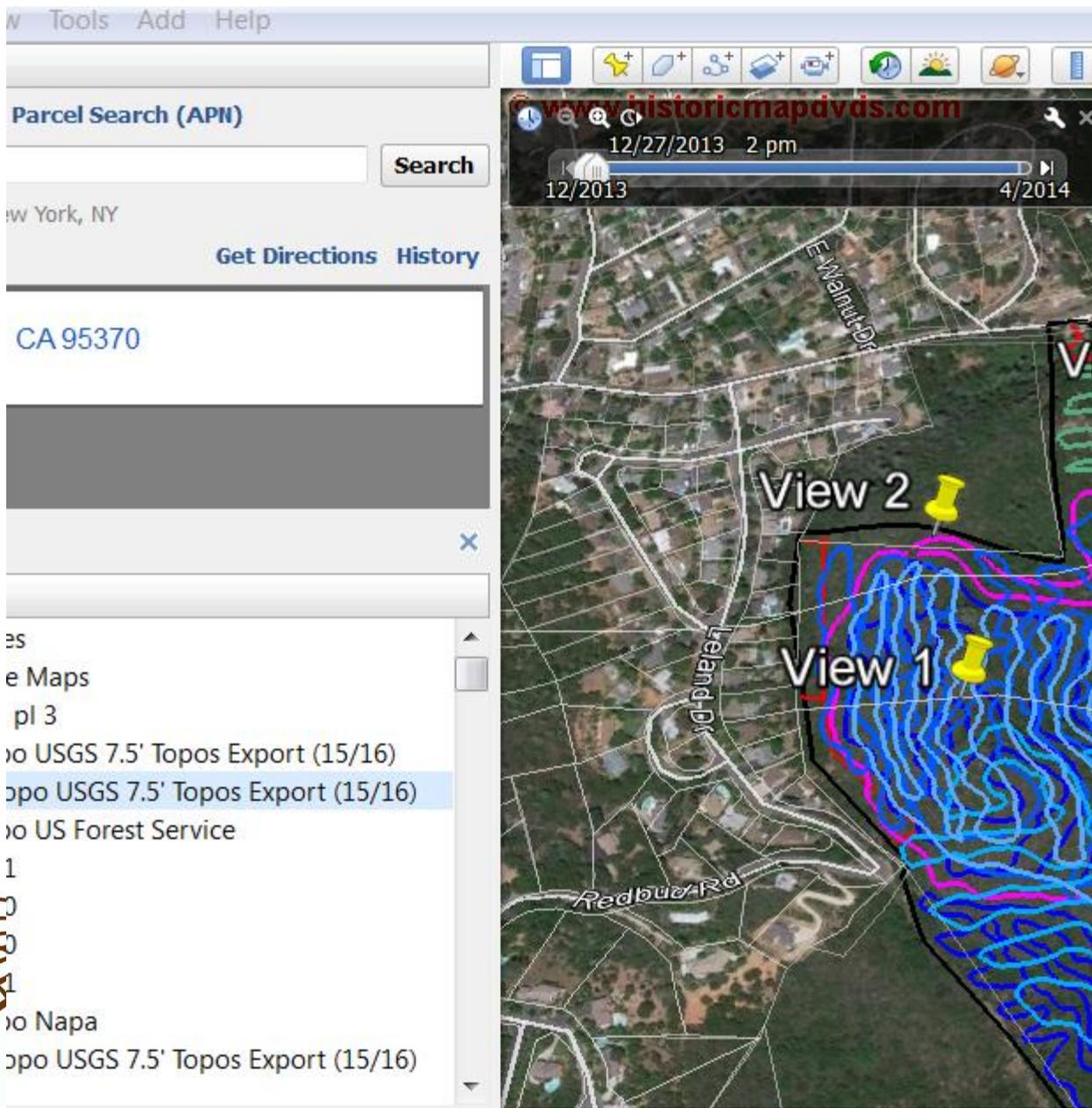
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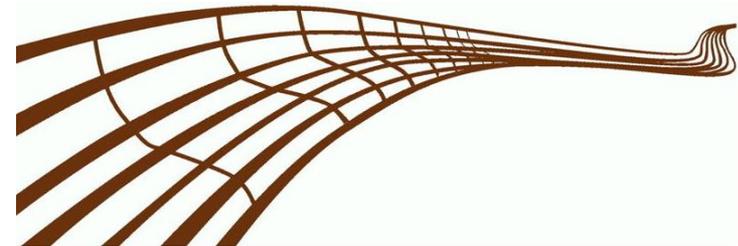
Handout.

Assignment

Lay out a trail at 5%

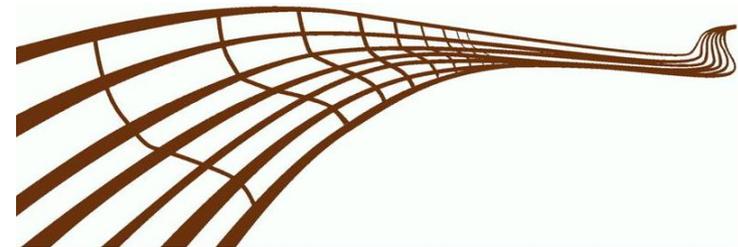
How long shall you draw before crossing a topo line?

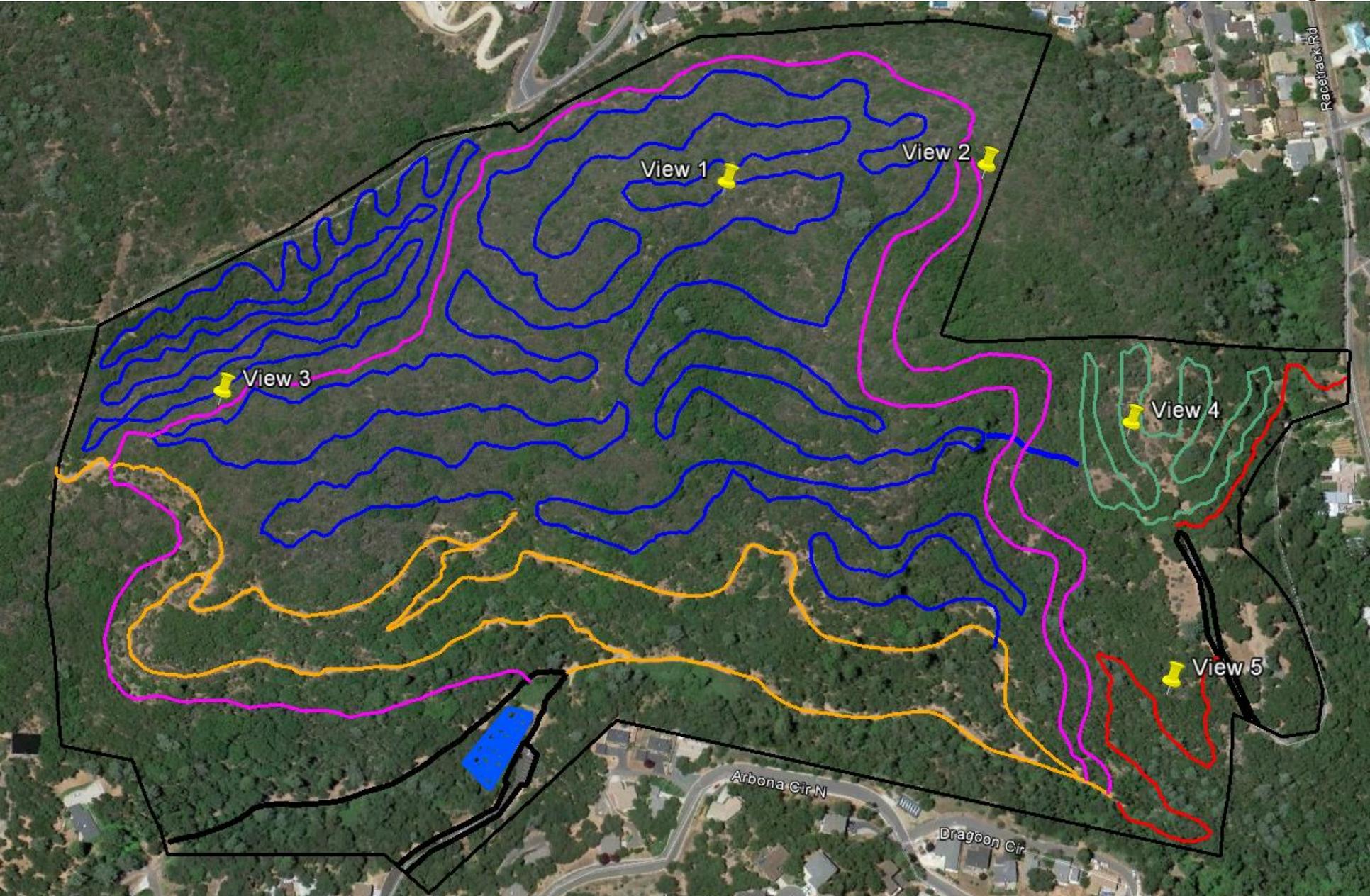
At 5%?



Assignment

- Questions?
 1. Where are the high points?
 2. Wow much elevation gain is there?
 3. How long does the trail have to be to get to the top at 5%?
 4. How far should you go before crossing a topo line at 5%
 5. Draw an interesting trail from the existing trail to the summit





View 1

View 2

View 3

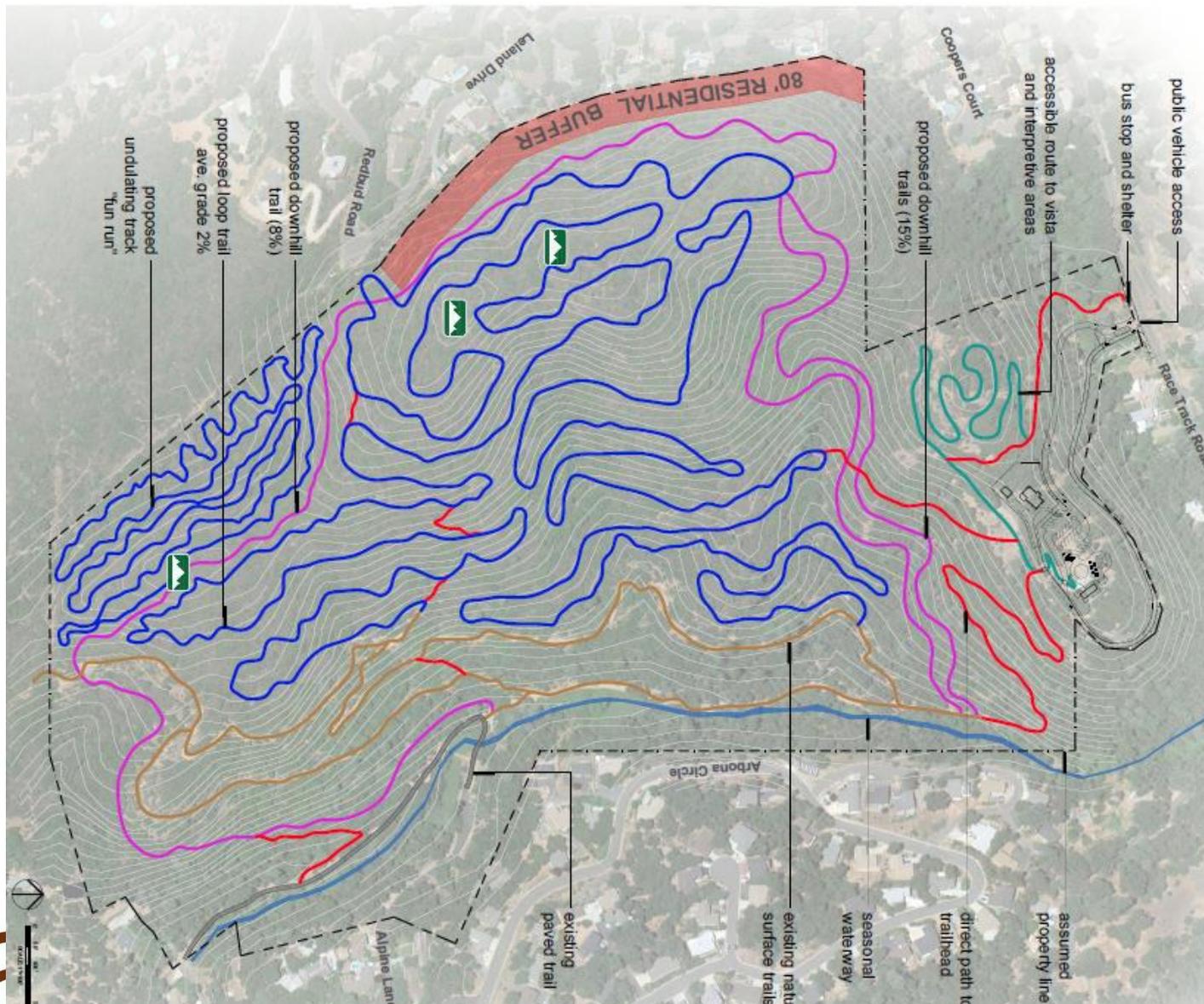
View 4

View 5

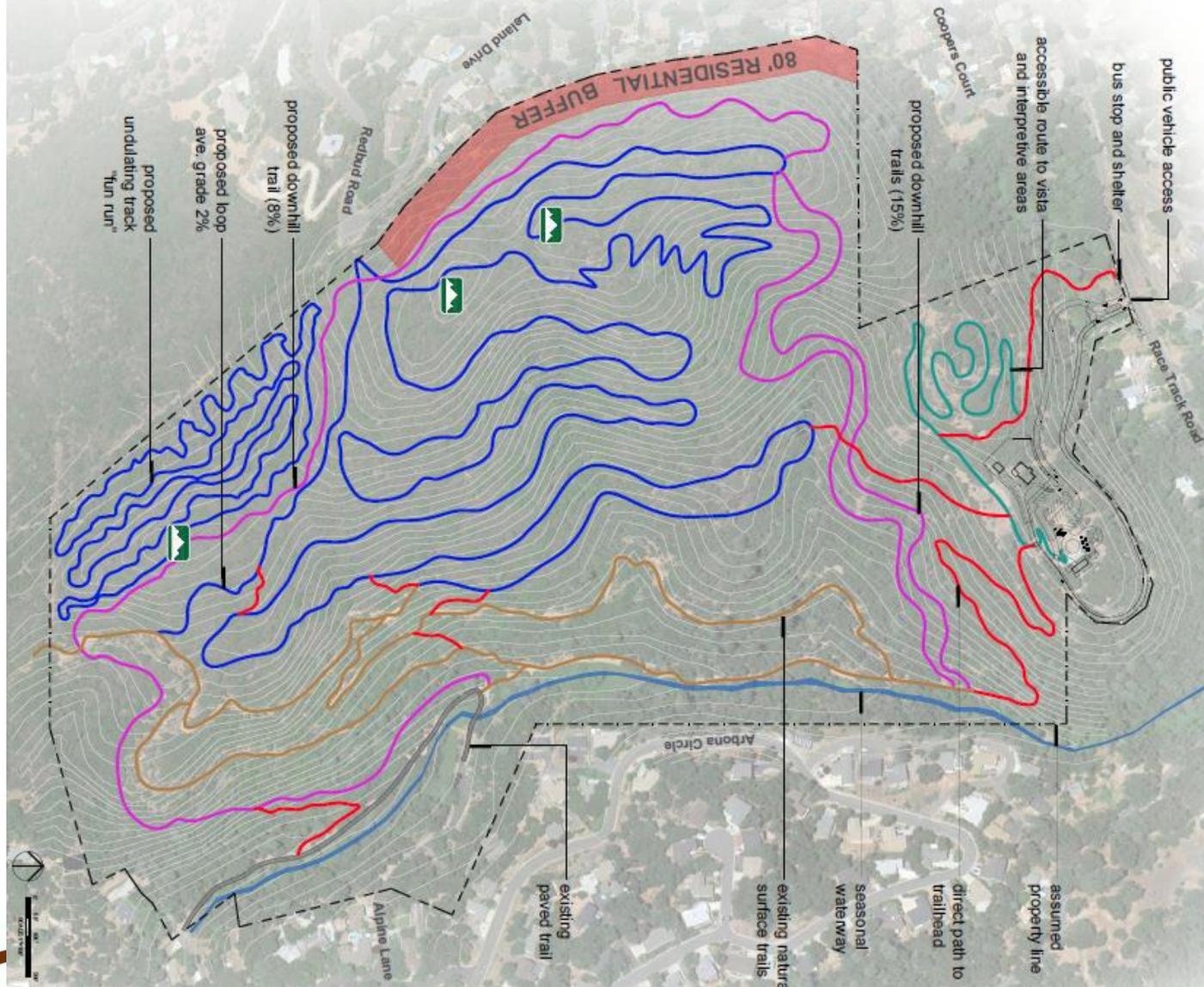
Arbona Cir N

Dragon Cir

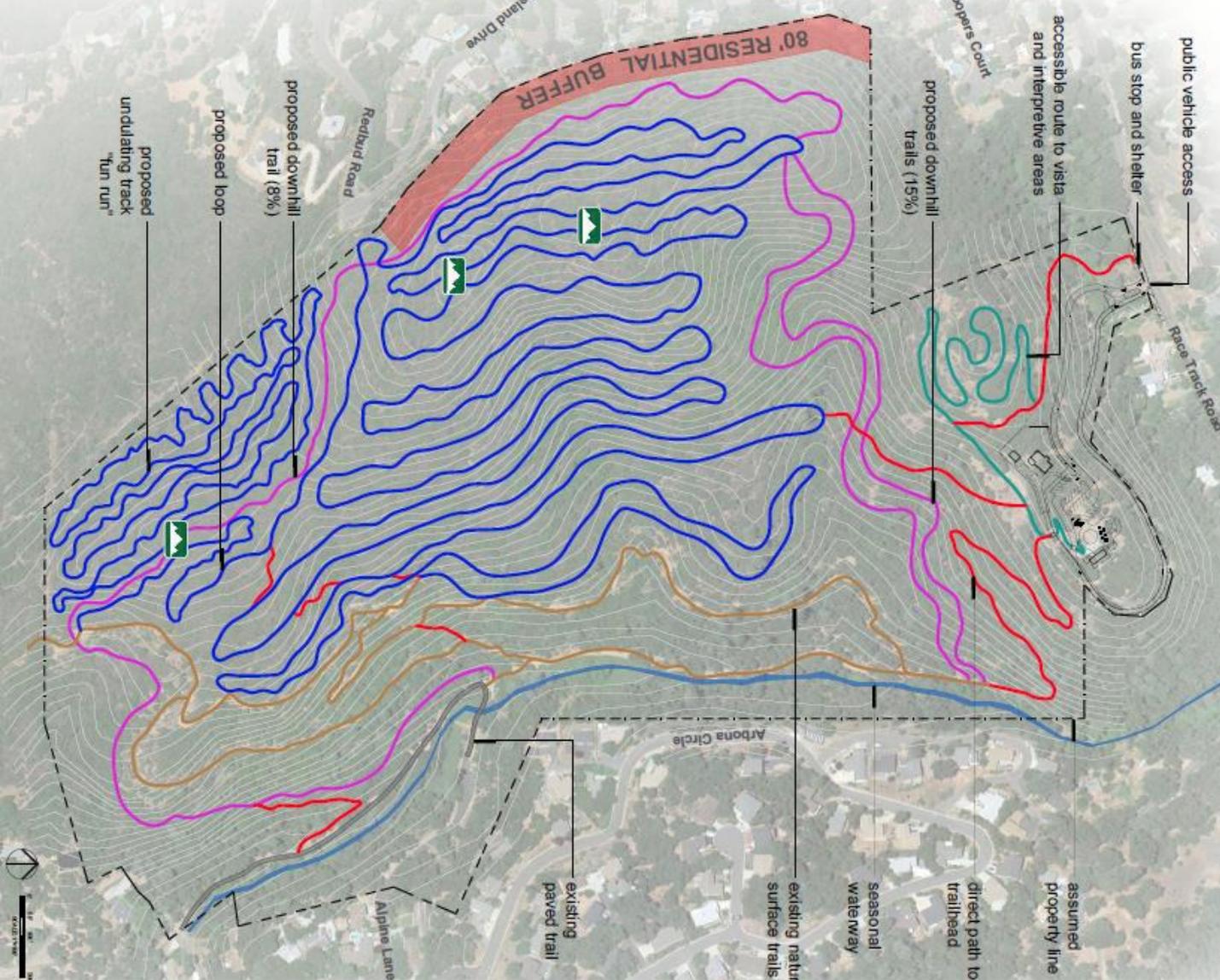
Racetrack Rd



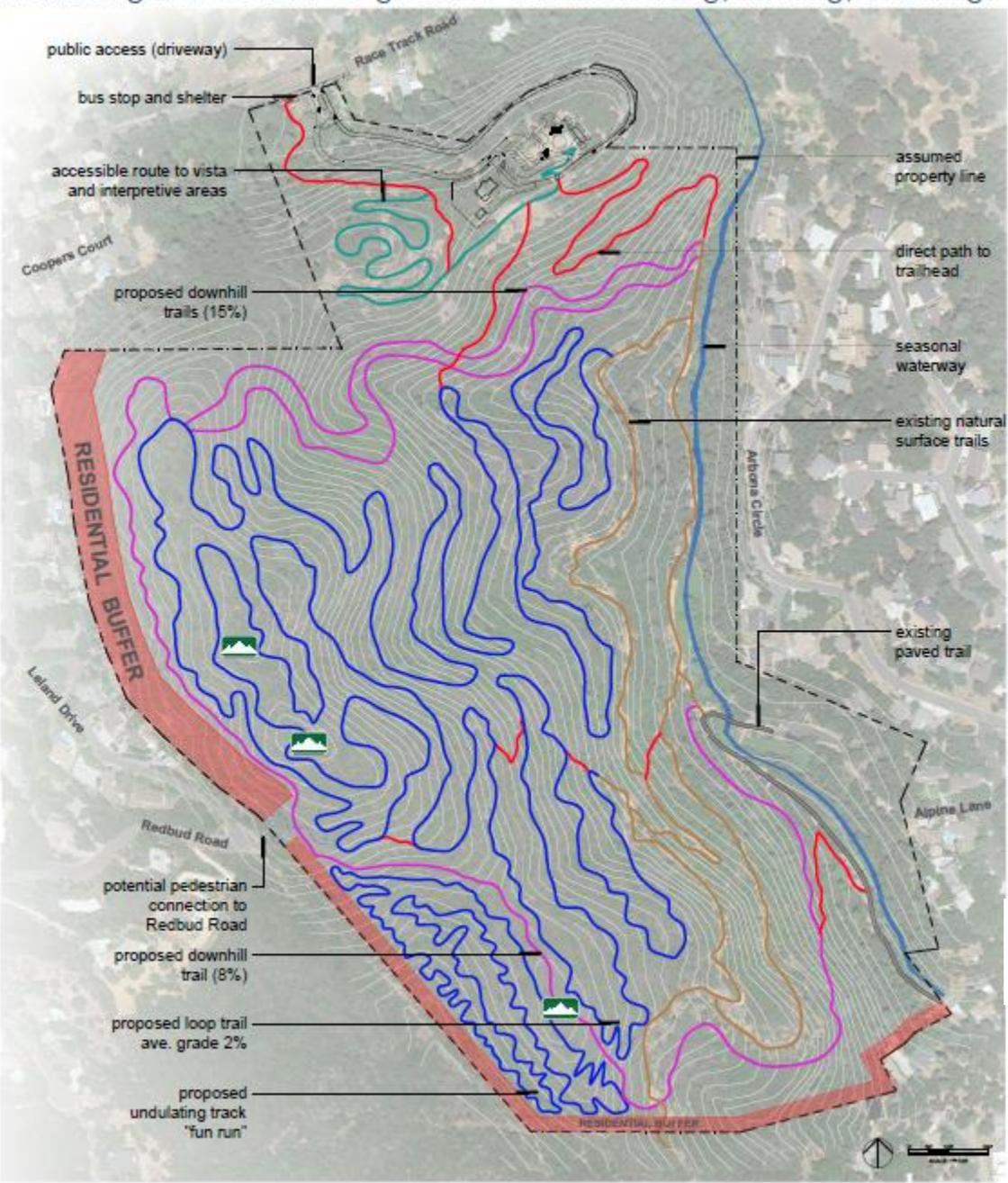
Option A maximizes diverse experiences. Different trail sections are custom designed for hikers, bikers, and walkers. Two summit paths are included, perimeter downhill sections with steeper grades accommodate serious bikers, and a "fun run" - a looped undulating trail section - is



Option B maximizes diverse experiences, but lessens the density and length of trail, providing the least impact to the natural area of all options. Different trail sections still accommodate various uses, but only one summit path is included. The "fun run" can be included or omitted



Option C maximizes the length of trail, while accommodating different uses, by switchbacking the central trail up the ravine to a single summit. To increase length, more turns density are needed. At the perimeter, different trail sections accommodate various uses, and the "fun run" can be included or omitted.



The **Preferred Alternative** maximizes diverse experiences. Different trail sections are custom designed for hikers, bikers, and walkers. Two summit paths are included, perimeter downhill sections with steeper grades accommodate serious bikers, and a "fun run" - a looped undulating trail section - is great for cardiac training, running, or biking.

length: 6.4 mi. | central trail ave. grade: 2% | downhill: 15% & 8%

TRAIL MASTER PLAN | PREFERRED ALTERNATIVE



DRAGON GULCH