

Hiker-Pedestrian Trail Design Parameters

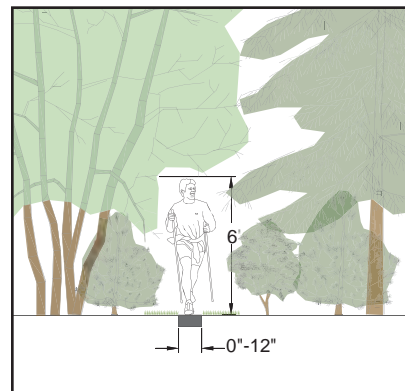
Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use HIKER-PEDESTRIAN		Trail Class 1	Trail Class 2	Trail Class 3*	Trail Class 4*	Trail Class 5*
Design Tread Width		0" – 12"	6" – 18"	18" – 48"	32" – 96"	36" – 120"
Design Surface	Type	Native, un-graded. Intermittent, rough.	Native with limited grading. Continuous, rough.	Native with some on-site borrow or imported materials.	Imported materials or hardening is common.	Uniform, firm, and stable.
	Obstacles	Roots, rocks, logs, steps to 24".	Roots, rocks and log protrusions to 6"; steps to 14".	Generally clear. Protrusions to 3"; steps to 10".	Smooth, few obstacles. Protrusions 2-3"; steps to 8".	Smooth, no obstacles. Protrusions <2".
Design Grade**	Target Range (>90% of Trail)	< 20%	< 15%	< 12%	< 10%	< 5%
	Short Pitch Max (Up to 200' lengths)	25%	20%	20%	15%	10%
	Max Pitch Density***	< 10% of trail	< 5% of trail	< 5% of trail	< 3% of trail	< 3% of trail
Design Cross-Slope	Target Range	Not applicable	5 – 10%	5 – 10%	3 – 7%	2 – 3% (or crowned)
	Maximum	Up to natural side-slope.	Up to natural side-slope	15%	10%	3%
Design Clearing	Width	Sufficient to define trail corridor.	24" – 36", with some encroachment into clearing area.	12" – 18" outside of tread edge.	12" – 18" outside of tread edge	12" – 24" outside of tread edge.
	Height	6'	6' – 7'	8'	8'	> 8'
Design Turns	Radius	No minimum.	2' – 3'	3' – 6'	4' – 8'	6' – 12'

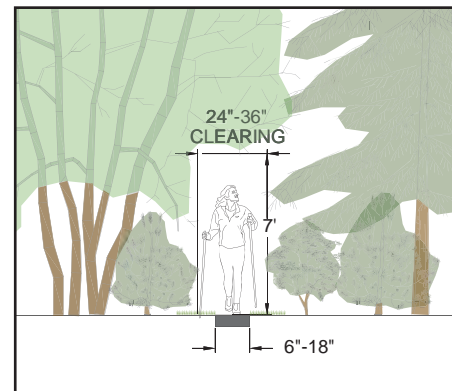
* Trail Classes 3, 4 and 5 may potentially provide accessible passage. If assessing or designing trails for accessibility, refer to current Agency trail accessibility guidance.

** Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential.

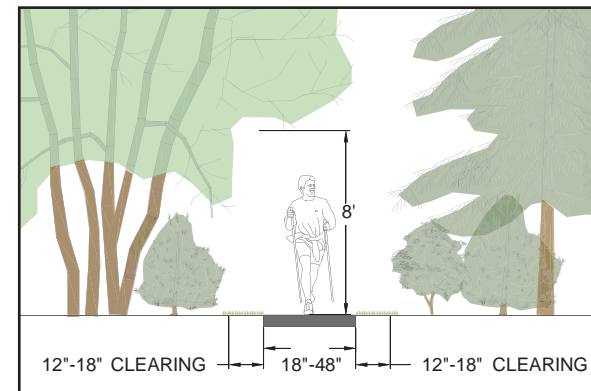
*** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.



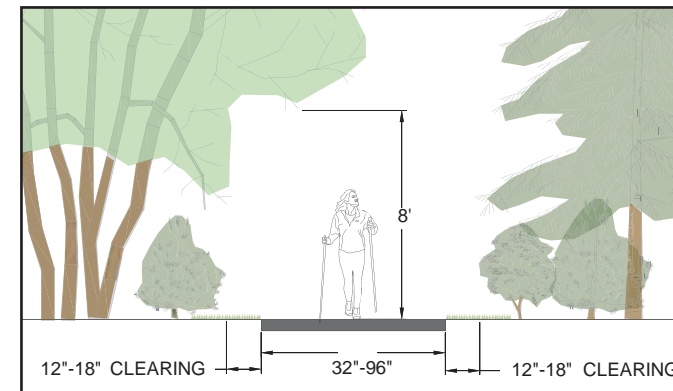
Trail Class 1



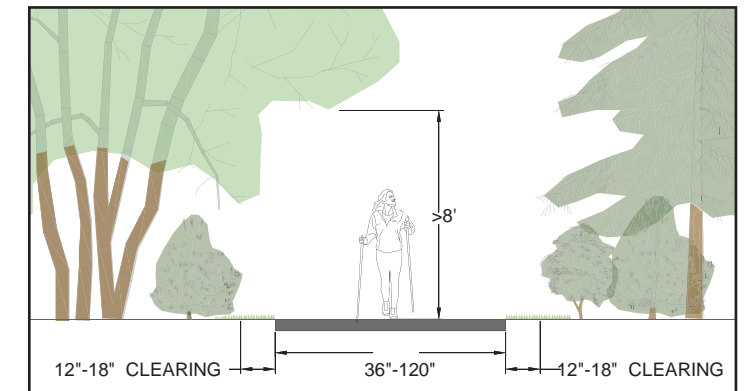
Trail Class 2



Trail Class 3



Trail Class 4



Trail Class 5

Far North Bicentennial Park Trail Improvements Plan

Figure 19



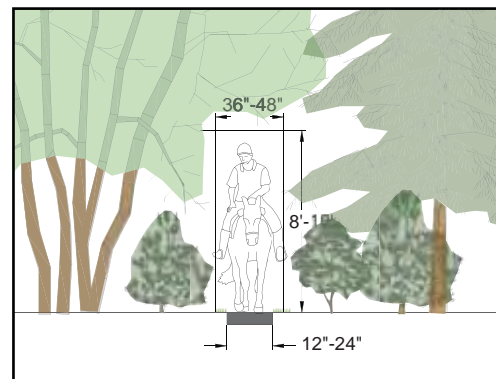
Pack and Saddle Trail Design Parameters

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

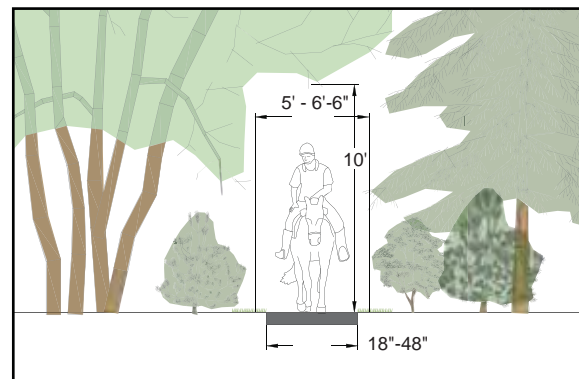
Designed Use PACK AND SADDLE	Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5	
Design Tread Width	Not Applicable: Not designed for equestrians as primary user, although equestrians may be present.	12" – 24" (With above exceptions)	18" – 48" (With above exceptions)	36" – 96"	Not Applicable: Not designed for equestrians as primary user. Equestrians generally not present.	
Design Surface		Type	Native, w/ limited grading.	Native with some on-site borrow or imported materials.		Native with some imported materials or stabilization.
		Obstacles	Roots, rocks, logs to 12"	Generally clear. Occasional protrusions to 6".		Smooth, few obstacles. Occasional protrusions 2-3".
Design Grade*		Target Range (>90% of Trail)	< 20%	< 12%		< 10%
		Short Pitch Max (Up to 200' lengths)	30%	20%		15%
		Max Pitch Density***	< 5% of trail	< 5% of trail		< 3% of trail
Design Cross-Slope		Target Range	5 – 10%	5%		5%
		Maximum	Natural side-slope	10%		10%
Design Clearing		Width	36" – 48"	60" – 78"		72" – 96"
		Height	8' – 10'	10'		10' - 12'
Design Turns	Radius	4' – 5'	5' – 6'	6' – 10'		

* Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential. Due to effects of use on tread and erosion, steeper pitches should be carefully evaluated based on potential effects of these various factors.

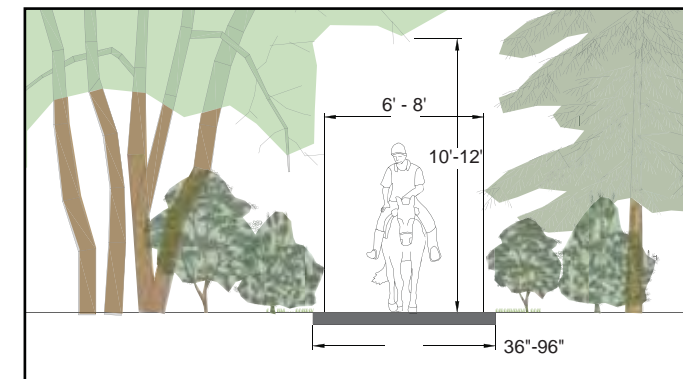
** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.



Trail Class 2



Trail Class 3



Trail Class 4

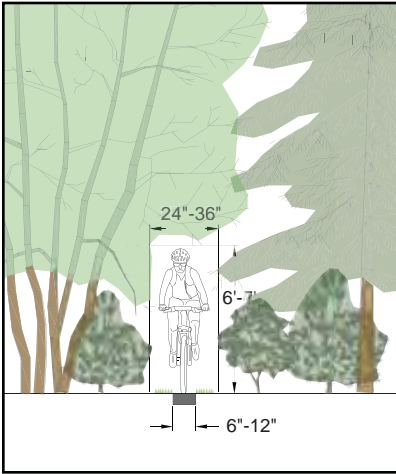


Bicycle Trail Design Parameters

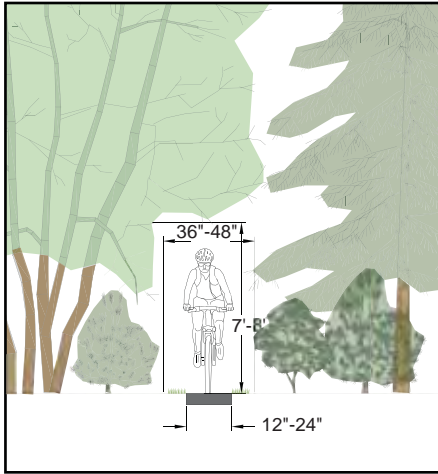
Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use BICYCLE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Tread Width	One Lane	6" – 12"	12" – 24"	18" – 30"	24" – 48"	36" – 60"
	Two Lane	Not applicable.	Not applicable.	48" – 60" Accommodate two-lane travel with passing lanes.	60" – 84"	72" – 120"
Design Surface	Type	Native. Rough, unstable or soft tread.	Native, with limited grading. Unstable or soft sections likely.	Native with some on-site borrow or imported materials. Some soft areas.	Likely imported or stabilized tread. Few, if any, loose or soft surfaces.	Firm, hardened surface.
	Obstacles	Rocks, logs and roots up to 6-12" common. Forced portages likely.	Embedded rock, protrusions to 6". Some portages may be needed.	Generally smooth with few protrusions exceeding 3".	Smooth, few obstacles. 1 – 2" protrusions.	No obstacles to wheeled transport.
Design Grade*	Target Range (>90% of Trail)	15% – 18%	< 12%	< 10%	< 8%	< 5%
	Short Pitch Max (Up to 200' lengths)	30% 50% on downhill-only travel.	25% 35% on downhill-only travel.	15%	10%	8%
	Max Pitch Density***	< 10% of trail	< 5% of trail	< 5% of trail	< 3% of trail	< 3% of trail
Design Cross-Slope	Target Range	5% – 10%	5% – 10%	5%	3% – 5%	3% – 5%
	Maximum					
Design Clearing	Width	24" – 36" Some vegetation may encroach into clearing area.	36" – 48" Some light vegetation may encroach into clearing area.	12" – 18" outside of tread edge.	12" – 18" outside of tread edge.	18" – 24" outside of tread edge.
	Height	6' – 7'	7' – 8'	8'	8' – 9'	8' – 9'
Design Turns	Radius	3' - 4'	4' – 6'	6' – 8'	8' – 10'	8' - 12'

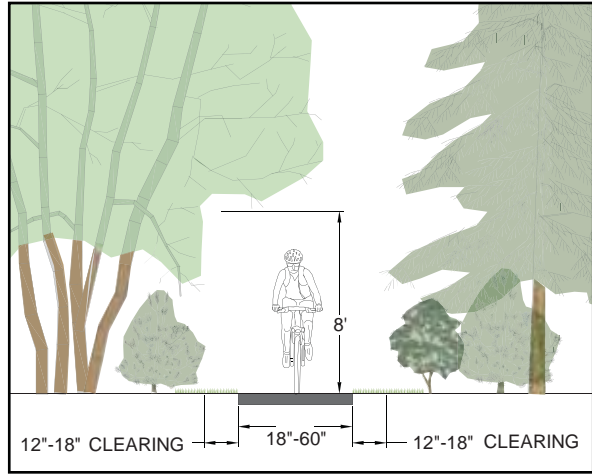
* Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential. Due to effects of use on tread and erosion, steeper pitches should be carefully evaluated based on potential effects of these various factors.
 ** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.



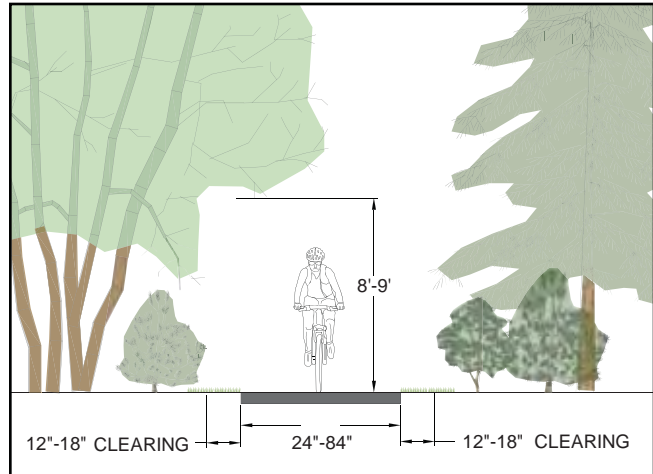
Trail Class 1



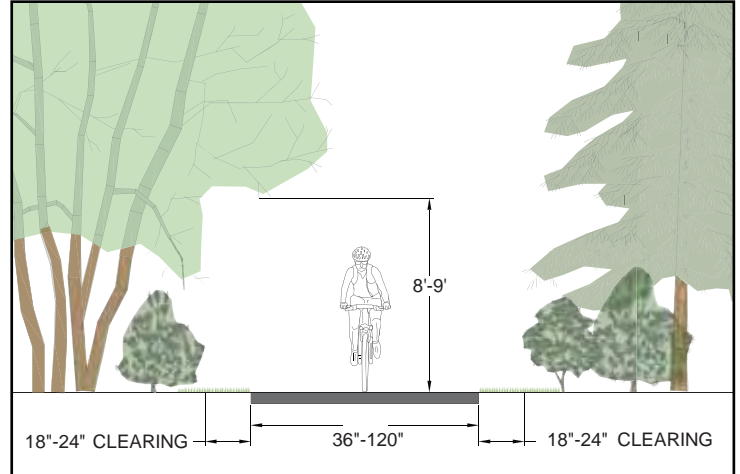
Trail Class 2



Trail Class 3



Trail Class 4



Trail Class 5

Far North Bicentennial Park Trail Improvements Plan

Figure 21



Bicycle

Nordic Skiing Trail Design Parameters

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use NORDIC SKIING (DIAGONAL/SKATE)		Trail Class 1	Trail Class 2	Trail Class 3*	Trail Class 4*	Trail Class 5*	Special
Design Groomed Width		N/A – (Not designed for skiing use – too narrow)	4'-8' Diagonal Only	8'-14' Diagonal and Skate (2 way); Diagonal only: 2 lanes, one way	12'-18' Two-way use. Recommend 8' – 10' wide (by at least 50' long) passing areas in steeper sections.	16'-24'	30' (3 skate lanes)
Design Grooming & Surface	Type		Coarse compaction. Occasional or no grooming (may be ski-packed). Snowmobile packing sufficient. Tracklayer optional.	Groomed or compacted using implements and/or tracklayer when packed surface is snow-covered, drifted, melted or skied out.	Smooth compaction using implements designed for creating skate lanes.	Smooth, well-groomed, using ski-specific equipment to provide a quality surface.	
	Obstacles [Caused by use, lack of grooming, melt, or surface/subsurface protrusions]		Dips, bumps, or ruts to 4" common and may be tightly spaced. Surface obstacles may occasionally require off-trail bypass.	Generally smooth surface, but small imperfections of subsurface may be acceptable.	Generally smooth surface, but small imperfections of subsurface may be acceptable.	Generally smooth surface, but small imperfections of subsurface may be acceptable.	
Design Grade**	Target Range (>90% of Trail)		<15%	<10%	<8%	6-8%	
	Short Pitch Max (Up to 200' lengths)		<25%	<20%	15%	12%	
	Max Pitch Density***		<10% of trail	<10% of trail	<5% of trail	<5% of trail overall; up to 8% for short stretches (50' maximum.)	
Design Cross-Slope	Target Range		<10%	<5%	<5% overall	<5% overall	
	Maximum [For up to 50']		20%	15%	12% Minimum cross-slope (crowned or one side) 2% to promote drainage	8% Minimum cross-slope (crowned or to one side) should be 2% to promote drainage.	
Design Clearing	Width		5'-7' (or minimum width of grooming equipment, if larger). Light vegetation may encroach into clearing area.	>1' outside of groomed edge. Light vegetation may encroach into clearing area.	Minimum of 1' outside of each groomed edge.	Width: Minimum 2' outside of groomed edge. Recommend more aggressive clearing (up to 5') to reduce seasonal maintenance.	
	Height [Above normal max. snow level]		6'-8' or height of grooming equipment.	>8' or height of grooming machinery.	Minimum of 8' from top of anticipated snowpack or height of grooming equipment (whichever is greater). Pruning of overhanging limbs to allow for snowfall on trail tread.	Height: At least 10' from top of anticipated snowpack, or height of grooming equipment (whichever is greater). Pruning of overhanging limbs to allow for snowfall on trail tread.	
Design Turns	Radius [Use Climbing Turns versus Switchbacks for Ski trails whenever possible]		50'; minimum based on radius turning limits of grooming machine.	50', or the minimum necessary to accommodate grooming equipment.	75'	75', or the minimum necessary to accommodate grooming equipment.	

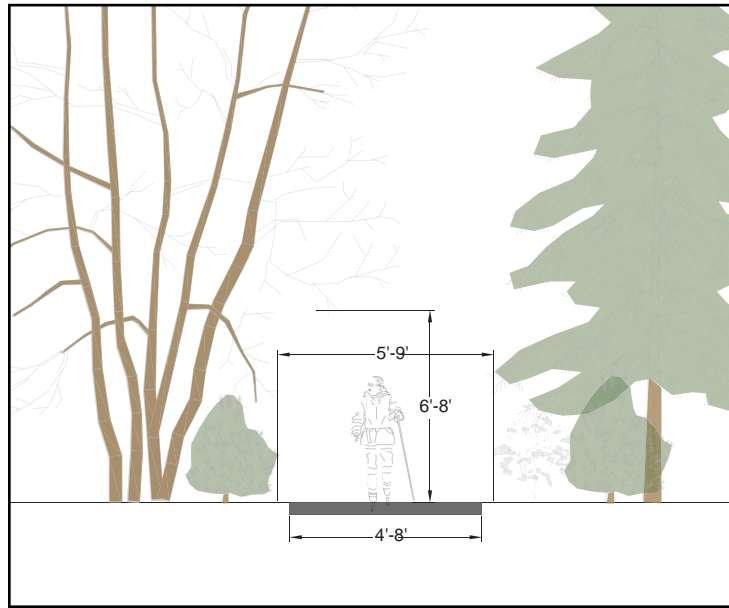
** Grade variances should be based upon factors such as common snow type, use levels, tightness of turns, and other factors contributing to surface stability and erosion potential.

*** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

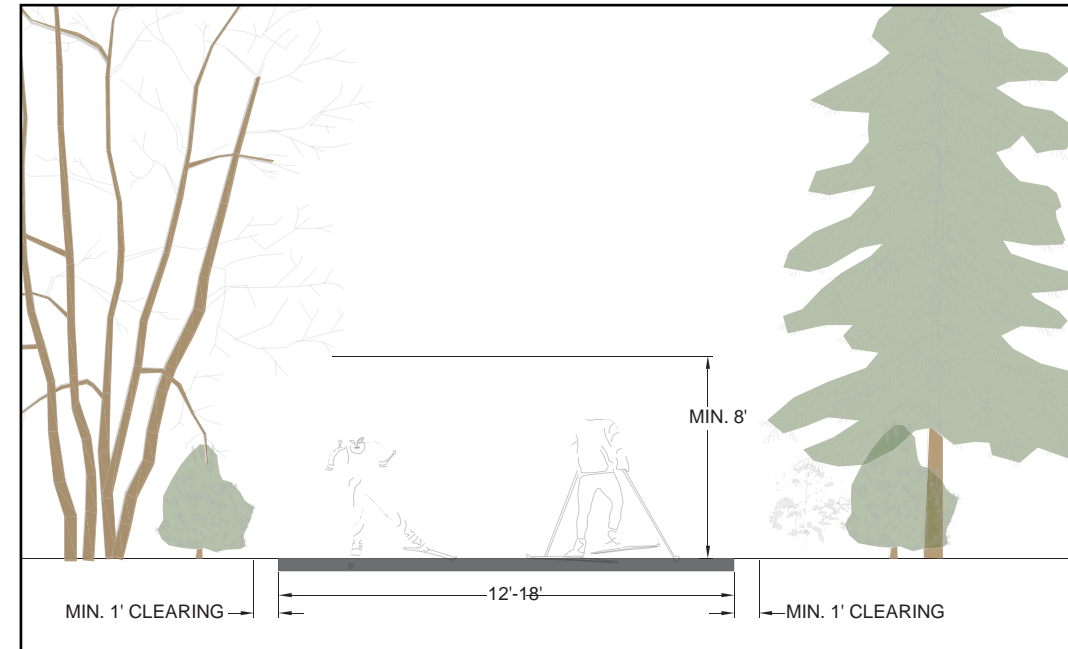
Far North Bicentennial Park Trail Improvements Plan

Figure 22

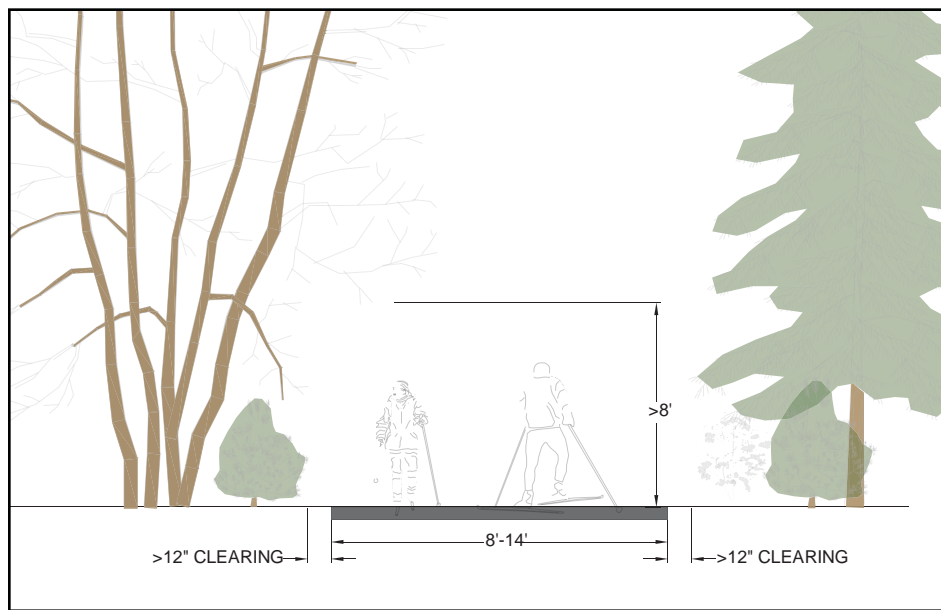




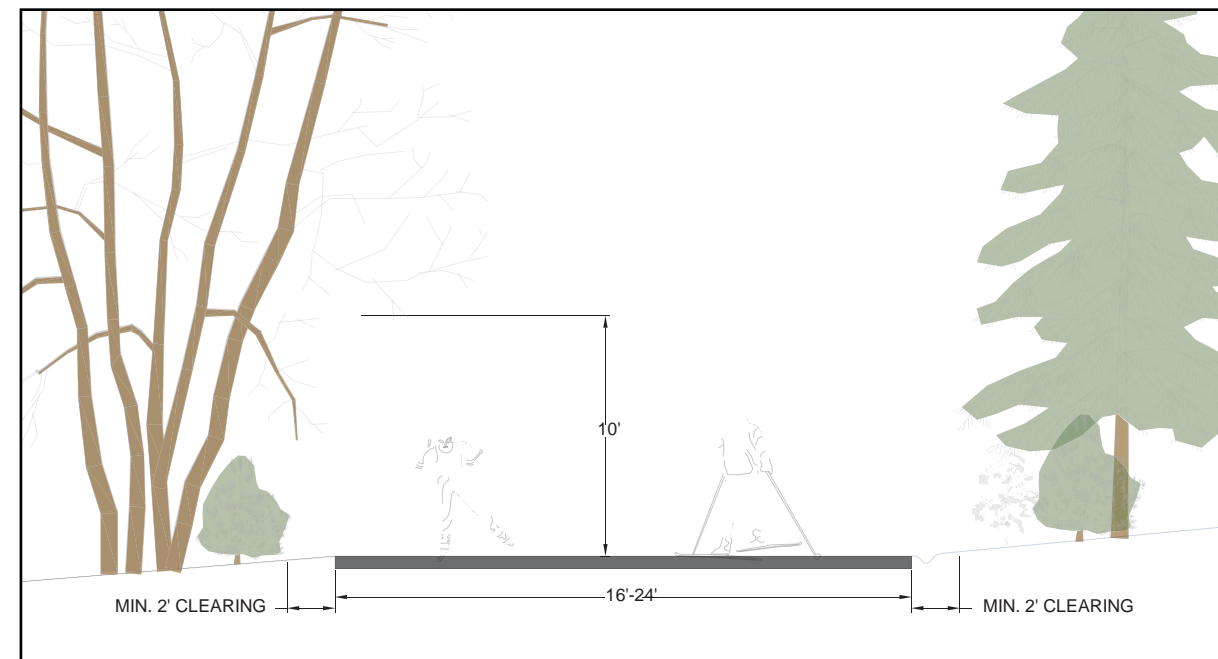
Trail Class 2



Trail Class 4



Trail Class 3



Trail Class 5

Far North Bicentennial Park Trail Improvements Plan

Figure 23



Dog Sledding Trail Design Parameters

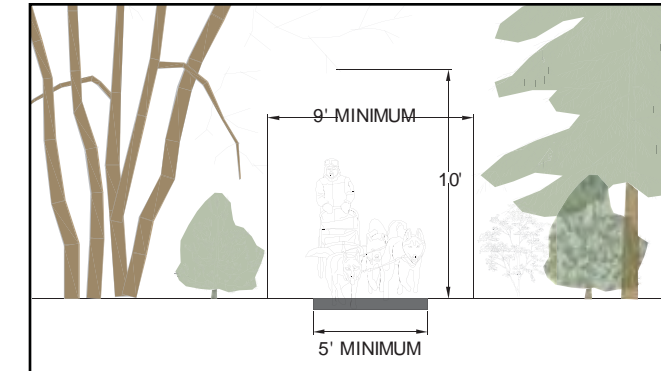
Designed Use DOG SLEDDING (Mushing)		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Groomed Width*		N/A – Not designed for dog sledding.	N/A – Not designed for dog sledding.	5' minimum	10'-15'+ width	N/A – Not designed for dog sledding.
Design Grooming & Surface	Type			Allowance for 3 ton grooming machine. Sub-snow surface should be packed dirt or gravel; not asphalt or concrete.	Width to accommodate available grooming equipment. Wider trails may allow teams to pass.	
	Obstacles <small>[Caused by use, lack of grooming, or sub- and surface and protrusions]</small>			Generally smooth. Dips, bumps, ruts to 12" infrequent and widely spaced. Surface obstacles not present.	Generally smooth surface, but small imperfections of subsurface may be acceptable.	
Design Grade*	Target Range <small>[>90% of Trail]</small>			Up to 15% running	Up to 10% running	
	Short Pitch Max <small>[Up to 200' lengths]</small>			20%	15%	
	Max Pitch Density**			<5% of trail	<5% of trail	
Design Cross-Slope	Target Range			2-5%, crowned or sloped to one side. (Enough to promote off-season sustainability, but not so much as to push users to sides of trail).	2-5%	
	Maximum			15%	10%	
Design Clearing	Width			9' - minimum	15-20' - (minimum)	
	Height <small>[Above normal maximum snow level]</small>			10' - minimum	10' - (minimum)	
Design Turns	Radius			100' radius (minimum)	100' radius (minimum)	
Other				250' minimum sight distance at trail intersections 100' parallel separation from other trails is preferable Multi-use and motorized right of way crossings must be grade-separated	250' minimum sight distance at trail intersections 100' parallel separation from other trails is preferable Multi-use and motorized right of way crossings must be grade-separated	

* Grade variances should be based upon factors such as common snow type, use levels, tightness of turns and others

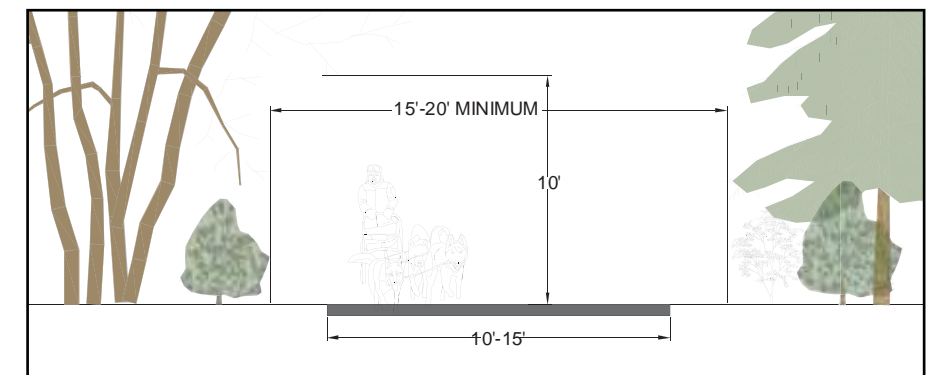
** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

Far North Bicentennial Park Trail Improvements Plan

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.



Trail Class 3



Trail Class 4

Dog Sledding (Mushing)

Figure 24



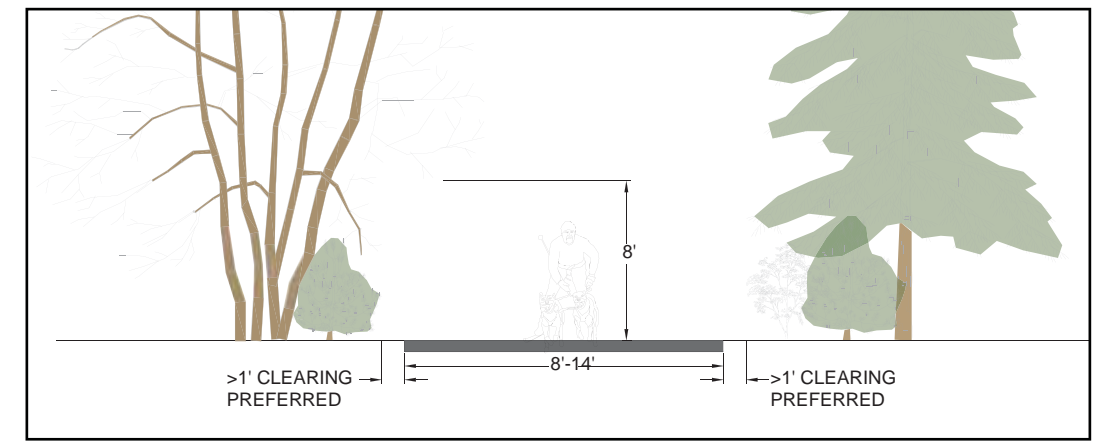
Skijoring Trail Design Parameters

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

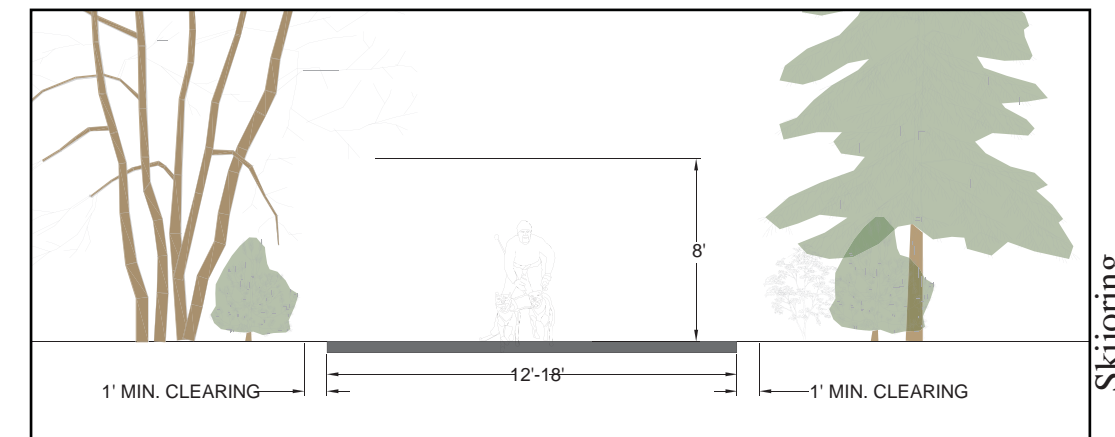
Designed Use SKIJORING		Trail Class 1	Trail Class 2	Trail Class 3*	Trail Class 4*	Trail Class 5*
Design Groomed Width		N/A – (Not designed for skate skiing use – too narrow)	N/A – (Not designed for skate skiing use – too narrow)	8'-14' Diagonal and Skate (2 way); Diagonal only: 2 lanes, one way	12'-18' Two-way use. Recommend 8' – 10' wide (by at least 50' long) passing areas in steeper sections.	16'-24'
Design Grooming & Surface	Type			Groomed or compacted using implements and/or tracklayer when packed surface is snow-covered, drifted, melted or skied out.	Smooth compaction using implements designed for creating skate lanes.	Smooth, well-groomed, using ski-specific equipment to provide a quality surface.
	Obstacles [Caused by use, lack of grooming, melt, or surface/subsurface protrusions]			Generally smooth surface, but small imperfections of subsurface may be acceptable.	Generally smooth surface, but small imperfections of subsurface may be acceptable.	Generally smooth surface, but small imperfections of subsurface may be acceptable.
Design Grade**	Target Range (>90% of Trail)			<10%	<8%	6-8%
	Short Pitch Max (Up to 200' lengths)			<20%	15%	12%
	Max Pitch Density***			<10% of trail	<5% of trail	<5% of trail overall; up to 8% for short stretches (50' maximum.)
Design Cross-Slope	Target Range			<5%	<5% overall	<5% overall
	Maximum [For up to 100']			15%	12% Minimum cross-slope (crowned or one side) 2% to promote drainage	8% Minimum cross-slope (crowned or to one side) should be 2% to promote drainage.
Design Clearing	Width			>1' outside of groomed edge. Light vegetation may encroach into clearing area.	Minimum of 1' outside of each groomed edge.	Width: Minimum 2' outside of groomed edge. Recommend more aggressive clearing (up to 5') to reduce seasonal maintenance.
	Height [Above normal max. snow level]			>8' or height of grooming machinery.	Minimum of 8' from top of anticipated snowpack or height of grooming equipment (whichever is greater) . Pruning of overhanging limbs to allow for snowfall on trail tread.	Height: At least 10' from top of anticipated snowpack, or height of grooming equipment (whichever is greater). Pruning of overhanging limbs to allow for snowfall on trail tread.
Design Turns	Radius [Use Climbing Turns versus Switchbacks for Ski trails whenever possible]			50', or the minimum necessary to accommodate grooming equipment.	75'	75', or the minimum necessary to accommodate grooming equipment.

** Grade variances should be based upon factors such as common snow type, use levels, tightness of turns, and other factors contributing to surface stability and erosion potential.

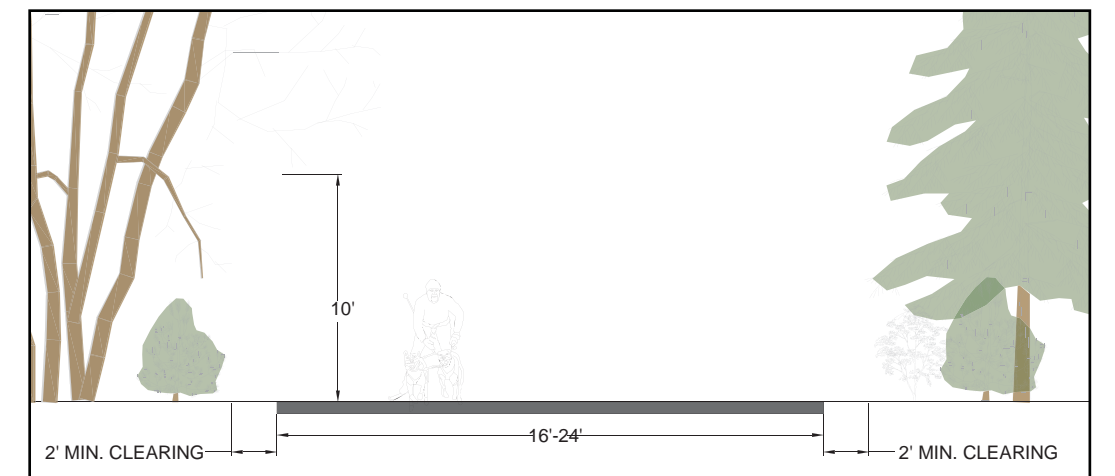
*** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.



Trail Class 3



Trail Class 4



Trail Class 5

Skijoring

Far North Bicentennial Park Trail Improvements Plan

Figure 25

