



City of Coquitlam

Trail Development Guidelines and Standards

February 2015



Coquitlam

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Trail Classifications

As a result of integrating the Off-Road Cycling strategy the category of trail types have been expanded. The trail types in the classification system are categorized accordingly:

Recreational Trails

- ❖ Urban Multi-use Trail
- ❖ Urban Nature Trail
- ❖ Nature Trail
- ❖ Trail Connector
- ❖ Park Pathways

Off-Road Recreational Cycling/Mountain Biking Trails

- ❖ Type I
- ❖ Type II
- ❖ Type III
- ❖ Type IV
- ❖ Type V

Recreational Trail Classification Matrix

	Surfacing	Trail Width	Capacity	Type of Use/ Accessibility	Location	Slope	Residential Buffer
URBAN MULTI-USE TRAIL^{1,5}	Asphalt or alternative Paving ² road mulch ⁵	3 – 4 m	High	Walking Jogging Cycling Roller Blading Stroller Wheelchair	Urban Area Major Park Fire Lane Service Road	Optimum 5% Maximum 8% Short Distance 10% Cross slope 2%	5 – 10 m
URBAN NATURE TRAIL	Crushed concrete ³ road mulch ⁵	2 – 3 m	High	Walking Jogging Cycling Stroller Wheelchair	Urban Natural Area Utility Corridor Fire Lane Service Road	Optimum 10% Maximum 30% Cross-Slop 2%	5 – 10 m
TRAIL CONNECTOR	Surface to match park trails	1.5 – 2 m	Low to Moderate	Walking Jogging Cycling Stroller	Urban Area Maximum Distance 100m	Prefer to maximum 8% over 15% steps required	5 – 10 m
NATURE TRAIL	Recycled road mulch	2 m	Low	Walking Mountain Biking	Natural Area Utility Corridor	Maximum 30% over 30% stairs required	5 – 10 m
PARK PATHWAYS	Asphalt, road mulch, concrete	1.8 m minimum	Low to High	Jogging Walking Cycling Stroller Wheelchair Service Access	Urban Parks Utility Corridor	Optimum 10% Cross-slope 2%	n/a

¹ Universal Access Standards mulch

² Refer to section on Construction Guidelines

³ 50% bark mulch, 50% road mulch variation

⁴ Used as a fire access / service road

⁵ Where the off-road recreational paved multi-use trail is integrated with the STP Bikeway system the standards for the development will follow the TAC guidelines.

Pedestrian Trail Difficulty Ratings:

Trails can provide a range of challenges for both pedestrians and cyclists. An obstacle or trail feature will pose a significantly different challenge to a hiker versus a cyclist. For example, a tight switchback with rock steps may be viewed as challenging to a mountain bike rider traveling downhill whereas a hiker walking uphill will view the same feature as no more difficult than a staircase. Therefore, hiking trails are rated according to the BC Parks *Trail Difficulty Definitions*, e.g. Garibaldi Park trails.

The BC Parks *Trail Difficulty Definitions* are determined based on length of the trail section, change in elevation and trail type for the average user.

Trail Difficult Rating:

E = Easy; M = Moderate; S = Strenuous; D = Difficult.

Pedestrian Trail Difficulty Ratings can be combined with *Trail Type Classifications* to provide potential users with a clear understanding of what to expect on the trail. For example, E - Type II will offer an easy walk on a surfaced 1.5-2.5 meter trail, whereas a S - Type III indicates to the user that a strenuous narrow trail with grades greater than 15% lies ahead.

Recreational Off-Road Cycling/Mountain Biking Trail Type Classification Matrix

Trail type classification is a critical step in establishing trail construction objectives as well as providing managers with a baseline in which to evaluate management and maintenance requirements. In an effort to maintain consistency throughout the corridor, this Trail Type Classification System has been developed using guidelines as described in the *Whistler Trail Standards (2003)* (See Appendix E for Web link) and the *B.C. Ministry of Forests, Recreation Manual (2000)*.

MOF Trail Classifications	Type I ¹	Type II ¹	Type III ²	Type IV ²	Type V ²
City of Coquitlam Trail Classifications	Urban Multi Use Access Road	Urban Nature Trail Trail Connector	Nature Trail	Nature Trail	Nature Trail
Tread Surface	Concrete or asphalt	Surfaced with compacted aggregates	Unsurfaced	Unsurfaced	Unsurfaced
Tread Width	2-4m	2m for doubletrack trails; 1m for singletrack trails	50-70cm	30-50cm	30-50cm
Clearing Width	Tread width plus 1m on each side	5m for doubletrack trails; 1.6m for singletrack trails	1.1m - 1.3m	1m	n/a
Typical Use	Non-motorized multi-use	Pedestrian Biking	Hiking Mountain biking	Hiking Mountain biking	Hiking Mountain bike
Tread Type	Paved double track	Doubletrack or singletrack	Singletrack	Single Track	Single Track
Typical Mountain Bike Difficulty Rating	n/a	Green circle	Green Circle Blue Square Black Diamond	Blue Square Black Diamond	Black Diamond

¹ Double-Track Off-road cycling trail typology and associated ratings do not restrict trail to a designated use. Hikers, trail runners, walkers and other users may use trails of any classification and rating.

² Single Track Off-road cycling trail typology and associated ratings do not restrict trail to a designated use. Hikers, trail runners, walkers and other users may use trails of any classification and rating. However, signage will be required at the start of trails (e.g. type III-V trails) to note specific usages to better prepare user expectations. See Appendix D for Off-road cycling trail.

Trail Type Design Guidelines

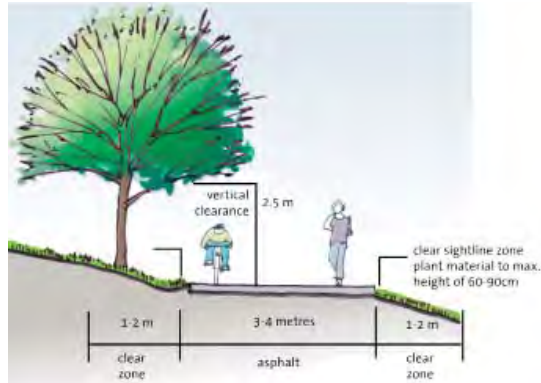
Urban Multi-Use (Off-Road) Trail

Characteristic Use: urban multi-use pathways, citywide greenways, major park, universal access, service/access, emergency road

Capacity: High

Type of Use/Accessibility: walking, jogging, cycling, rollerblading, stroller, wheelchair, maintenance access

Location: urban area, manicured park, fire lane, terrain maximum 8%; -10% for short distances



Design Guidelines:

Width: 3-4 m

Surfacing: Asphalt or alternative paving.

Slope: optimum maximum 5%, maximum 8%, 10% for short distances, cross-slope 2%.

Clear Sightline Zone: 1.0 – 2.0m width from edge of path; plant material maintained to a maximum mature height of 60-90 cm.

Landscape treatment: low, soft landscape treatment between edge of trail to property line, fence or barrier, shall be to a maximum height of 60 cm. The type of treatment shall match existing, preferably with plant material that is native or combination of native and ornamental, non-invasive and non-bear attractant especially in areas with known bear habitat and activity.

Barriers at Trailhead: Bollards or Baffle (see Trailheads).

Entry Gates/ Trailhead: Trail entry points shall be well marked with connection to public sidewalk with consistent signage. See Major or Minor Trailhead for guidelines.

Universal Access: throughout; install signage at trail entry noting trail to be wheelchair friendly where applicable.

Riparian Environmental Sensitive Areas (ESA): In accordance with City Wide Official Community Plan (CWOCP) and ESA reports and Riparian Area Regulations (RAR) guidelines.

Residential Buffer Setback: 5-10m, measured from the property line.

Barriers/ Spatial Delineation: Where new trail sections are constructed adjacent to riparian and conservation/environmentally sensitive areas, fencing as accepted by DFO will be installed, with associated landscaping (where appropriate). See example fence in Appendix A.

Where new trail sections are proposed for construction by the City adjacent to existing residential homes and where there is no existing privacy delineation in place on private property, the City will follow applicable CPTED principles and recommendations. In consultation with property owners, agreed appropriate action may include no action, installation of visually permeable hedging or privacy and safety fencing (to city and CPTED standards, installed on private property), along with associated landscaping (between trail and property line).

Root Barriers: recommended in areas where existing tree species are known to be prone to surface rooting, i.e. Poplar. Follow manufacturers recommended installation.

Drainage: varies to respond to site situation: shallow swale on uphill side, culvert at low points, sheet flow, French drain, center crown or permeable paving. Geotextile fabric is required on wet and unstable upgrade.

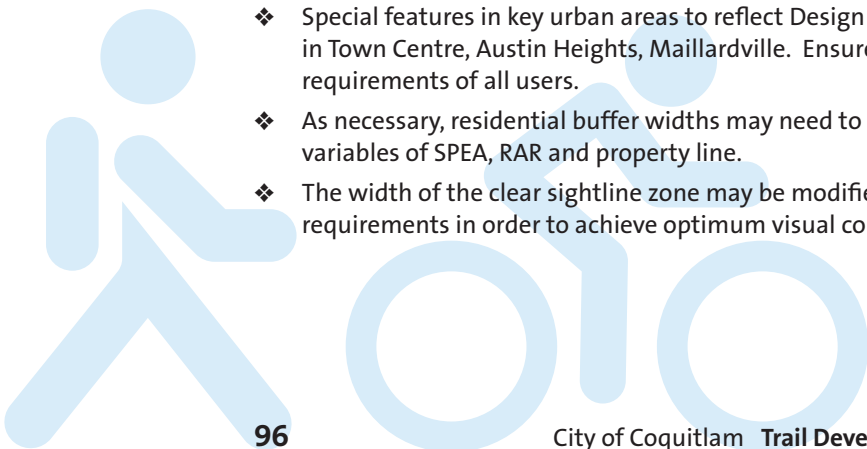
Horizontal Curves: ensure adequate sightlines on corners. Include centre line stripes on curves with sharp corners and poor sightlines.

Signage: use of trail markings and signage where applicable to direct and separate pedestrians and wheeled users on shared multi-use trails. Trail identification or name signage to clearly identify natural trail entry points combined with specific trail information identifying experience, length, slope, difficulty, permitted/suggested uses etc. for users to better make informed decisions and prepare expectations.

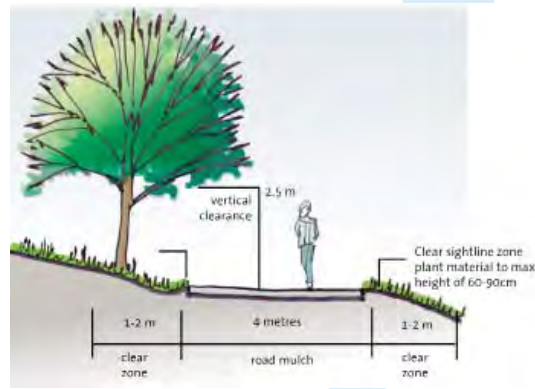
At existing locations where public trails end at private property, and where necessary, a barrier/ barricade and/or two signs shall be installed. One sign shall include a map clearly showing public trail and route to bypass private property or indicate the trail ends and the user must turn back. The second sign shall read “Private Property – No Trespassing”.

Potential Variation:

- ❖ Where level of use causes conflict between users or in areas where there is significant use, use by in-line skaters and off-road/mountain bike cyclists, the width shall be 4.0m.
- ❖ Subcategory: Fire lane and service/access road use. For servicing and emergency access, the trail shall be 4.0m width of asphalt, granular or grass grid.
- ❖ In specific areas, such as an urban waterfront path with commercial uses i.e. Fraser Mills, width may be as wide as 8.0m.
- ❖ High volume trails may require delineation of uses/users through lane markings, signage and physical separation.
- ❖ Where the off-road recreational trail is also integrated as part of the city wide greenway and cycling network (i.e., Como Lake Ave. at Mundy Park), they shall follow the standards set in the city Strategic Transportation Plan and TAC Guidelines. Refer to STP for guidelines on sight distances, horizontal curves, illumination, road crossings, bicycle parking, signs, and pavement markings on curves and at bollards.
- ❖ Special features in key urban areas to reflect Design Guidelines, e.g. ornamental paving in Town Centre, Austin Heights, Maillardville. Ensure surfacing is smooth and meets requirements of all users.
- ❖ As necessary, residential buffer widths may need to adjust according to site conditions and variables of SPEA, RAR and property line.
- ❖ The width of the clear sightline zone may be modified to accommodate site specific requirements in order to achieve optimum visual corridors and sight lines.



Variation: For Fire and Access Road:



Maintenance: The maintenance level is determined according to a set of criteria - refer to the Trails Maintenance and Operations Section. City contact information is posted for public reporting of maintenance concerns i.e. repairs/damage, trail obstruction, and vandalism.

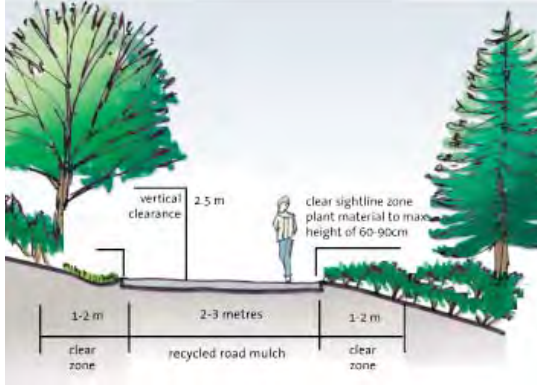
Urban Nature Trail

Characteristic Use: major park, universal access

Capacity: High

Type of Use/ Accessibility: walking, jogging, cycling, strollers, wheelchair

Location: urban area, manicured park, fire lane, terrain maximum 10% slope



Design Guidelines:

Width: 2 – 3m

Surfacing: Recycled road mulch aggregate (option with wood mulch combination)

Slope: optimum < 10%, maximum 30% for short distances, cross-slope 2%.

Clear Sightline Zone: 1.0 – 2.0m width from edge of path; plant material maintained to a maximum height of 60-90 cm.

Landscape treatment: low, soft landscape treatment between edge of trail to property line, fence or barrier, shall be to a maximum height of 60 cm. The type of treatment shall match existing, preferably with plant material that is native or combination of native and ornamental, non-invasive and non-bear attracting especially in areas with known bear habitat and activity.

Universal Accessibility: where achievable; Install signage at trail entry noting the trail is wheelchair friendly.

Entry Gates/ Trailhead: See Major or Minor Trailhead for guidelines.

Barriers at Trailhead: Bollard or Baffle (see Trailheads).

Riparian ESAs: in accordance with City ESA reports and RAR guidelines.

Residential Buffer Setback: 5-10m, measured from the property line.

Barriers/ Spatial Delineation: Where new trails sections are constructed adjacent to riparian and conservation/environmentally sensitive areas, fencing as accepted by DFO will be installed, with associated landscaping (where appropriate). See example fence detail D19.

Where new trail sections are proposed for construction by the City adjacent to existing residential homes and where there is no existing privacy delineation in place on private property, the City will follow applicable CPTED principles and recommendations. In consultation with property owners, agreed appropriate action may include no action, installation of visually permeable hedging, or privacy and safety fencing (to city and CPTED standards, installed on private property), along with associated landscaping (between trail and property line).

Drainage: varies to respond to site situation shallow swale on uphill side, culvert at low points, sheet flow, French drain, center crown. Geotextile fabric is required on wet and unstable subgrade.

Rest Areas: general guideline of 0.5 km between benches or rest areas.

Signage: use of signage where applicable to direct and separate pedestrians and wheeled users on shared multi-use trails. Trail identification or name signage to clearly identify natural trail entry points combined with specific trail information identifying experience, length, slope, difficulty, permitted/suggested uses etc. for users to better make informed decisions and prepare expectations.

At existing locations where public trails end with private property, and where necessary, a barrier/barricade and/or two signs shall be installed. One sign shall include a map clearly showing public trail and route to bypass private property or indicate the trail ends and the user must turn back. The second sign shall read "Private Property – No Trespassing".

Potential Variation:

- ❖ Path surface: 50/50 road mulch and wood chips.
- ❖ Asphalt sections in very high use areas.
- ❖ 1.5 m to 2m wide for pedestrians only or low use areas.
- ❖ Over 30% slope, steps required.
- ❖ The width of the clear sightline zone may be modified to accommodate site specific requirements in order to achieve optimum visual corridors and sight lines.
- ❖ As necessary, residential buffer widths may need to adjust according to site conditions and variables of SPEA, RAR and property lines.

Maintenance: The maintenance level is determined according to a set of criteria - refer to the Trails Maintenance and Operations Section. City contact information is posted for public reporting of maintenance concerns i.e. repairs/damage, trail obstruction and vandalism.

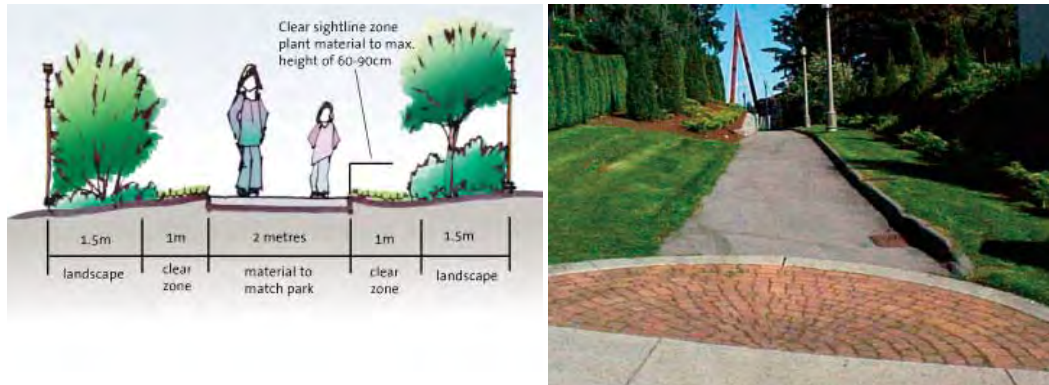
Trail Connector

Characteristic Use: Short distance and connectors to main trail routes and loops

Capacity: varies with width of trail: high to low

Type of Use/ Accessibility: walking, jogging, cycling, stroller, wheelchairs

Location: urban area – maximum 100 m distance, terrain maximum 30% slope



Design Guidelines:

Width: 1.5 - 2m

Surfacing: Asphalt, concrete, alternate paving.

Slope: prefer to maximum of 8%, over 15% - steps required.

Clear Sightline Zone: 1-2m width from edge of path; plant material maintained to a maximum height of 60-90 cm.

Landscape treatment: low, soft landscape treatment between edge of trail to property line, fence or barrier, shall be to a maximum height of 60 cm. The type of treatment shall match existing, preferably with plant material that is native or combination of native and ornamental, non-invasive and non-bear attracting especially in areas with known bear habitat and activity.

Universal Accessibility: where achievable (to include wheelchair friendly signage).

Entry Gates/ Trailhead: See Major or Minor Trailhead for guidelines.

Barriers at Trailhead: Bollard or Baffle (see Trailheads).

Riparian ESAs: In accordance with City ESA reports and RAR guidelines.

Residential Buffer Setback : 5-10m, measured from the property line.

Barriers/ Spatial Delineation: Where new trails sections are constructed adjacent to riparian and conservation/environmentally sensitive areas, fencing as accepted by DFO will be installed, with associated landscaping (where appropriate). See example fence in Appendix A.

Where new trail sections are proposed for construction by the City adjacent to existing residential homes and where there is no existing privacy delineation in place on private property, the City will follow applicable CPTED principles and recommendations. In consultation with property owners, agreed appropriate action may include no action, installation of visually permeable hedging, or privacy and safety fencing (to city and CPTED standards, installed on private property), along with associated landscaping (between trail and property line).

Root Barriers: min. 5.0m length centered about the trees for protection. e.g. Deep Root barriers

Drainage: sheet flow with 2% max cross slope to drainage strip on low side. Geotextile fabric is required on wet and unstable subgrade.

Signage: use of trail markings and signage where applicable to direct and separate pedestrians and wheeled users. Trail identification or name signage to clearly identify natural trail entry points and if applicable, specific trail information identifying experience, length, slope, difficulty, permitted/suggested uses etc. for users to better make informed decisions and prepare expectations.

At existing locations where public trails end at private property, and where necessary a barrier/ barricade and/or two signs shall be installed. One sign shall include a map clearly showing public trail and route to bypass private property or indicate the trail ends and the user must turn back. The second sign shall read “Private Property – No Trespassing”.

Potential Variation:

- ❖ A bicycle swale on one side of the trail may be required.
- ❖ The width of the sightline clear zone may be modified to accommodate site specific requirements in order to achieve optimum visual corridors and sight lines.
- ❖ As necessary, residential buffer widths may need to adjust according to site conditions and variables of SPEA, RAR and property line.

Maintenance: The maintenance level is determined according to a set of criteria - refer to the Trails Maintenance and Operations Section. City contact information is posted for public reporting of maintenance concerns i.e. repairs/damage, trail obstruction and vandalism.

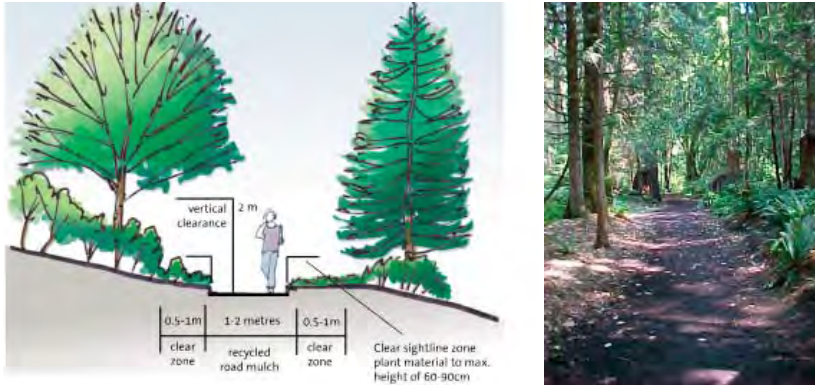
Nature Trail

Characteristic Use: Natural Setting

Capacity: Low

Type of Use/ Accessibility: walking, mountain biking

Location: natural area, utility corridor, terrain maximum 50% slope



Design Guidelines:

Width: 2m where possible

Surfacing: recycled road mulch or concrete or (option with wood mulch combination).

Slope: Trail maximum 30%, over 30% stairs are required.

Clear Sightline Zone: 0.5- 1.0m width from edge of path; plant material maintained to a maximum height of 60-90 cm.

Landscape treatment: low, soft landscape treatment between edge of trail to property line, fence or barrier, shall be to a maximum height of 60 cm. The type of treatment shall match existing, preferably with plant material that is native or combination of native and ornamental, non-invasive and non-bear attracting especially in areas with known bear habitat and activity.

Barriers at Trailhead: Baffle or Bollard, where required to control unauthorized vehicular access.

Entry Gates/ Trailhead: See Major or Minor Trailhead for guidelines

Soft Subgrade: where subgrade is unstable or saturated, geotextile fabric will be installed.

Riparian ESAs: In accordance with City ESA reports and RAR guidelines.

Residential Buffer Setback: 5-10m, measured from the property line.

Barriers/ Spatial Delineation: Where new trails sections are constructed adjacent to riparian and conservation/environmentally sensitive areas, fencing as accepted by DFO will be installed, with associated landscaping (where appropriate). See example fence in Appendix A.

Where new trail sections are proposed for construction by the City adjacent to existing residential homes and where there is no existing privacy delineation in place on private property, the City will follow applicable CPTED principles and recommendations. In consultation with property owners, agreed appropriate action may include no action, installation of visually permeable hedging, or privacy and safety fencing (to city and CPTED standards, installed on private property), along with associated landscaping (between trail and property line).

Drainage: minimal, shallow swale on uphill side where required with culvert at low points. Geotextile fabric is required on wet and unstable subgrade.

Rest Areas: provide benches only at trailheads and at special features, e.g. viewpoint, information and interpretative signage.

Signage: Trail identification or name signage to clearly identify natural trail entry points combined with specific trail information identifying experience, length, slope, difficulty, permitted/suggested uses etc. for users to better make informed decisions and prepare expectations.

At existing locations where public trails end at private property, and where necessary, a barrier/barricade and/or two signs shall be installed. One sign shall include a map clearly showing public trail and route to bypass private property or indicate the trail ends and user must turn back. The second sign shall read “Private Property – No Trespassing”.

Potential Variation:

- ❖ Add crushed concrete to surface in higher use areas.
- ❖ Work with user groups to identify and designate trails suitable and unsuitable for mountain biking. Some trail segments may be designated single use, i.e. pedestrian or bike only.
- ❖ Drainage culverts crossing path for drainage on the rougher trails.
- ❖ Barriers and bollards: large boulder instead of bollard.
- ❖ The width of the sightline clear zone may be adjusted to accommodate site specific requirements so as to achieve optimum visual corridors and sightlines.
- ❖ As necessary, residential buffer widths may need to adjust according to site conditions and variables of SPEA, RAR and property lines.
- ❖ Use for mountain bike cycling, trail widths may vary according to trail type. Refer to Appendix D for more detailed information.
- ❖ Where existing and potential “hot spots” of nuisance activity are identified, the Nature Trail profile shall be upgraded to an Urban Nature Trail profile, e.g. adjacent residential development. The wider trail section will attract more volume of use and help socialize the trail and modify unwelcomed behaviour.

Maintenance: The maintenance level is determined according to a set of criteria - refer to the Trails Maintenance and Operations Section. City contact information is posted for public reporting of maintenance concerns i.e. repairs/damage, trail obstruction and vandalism.

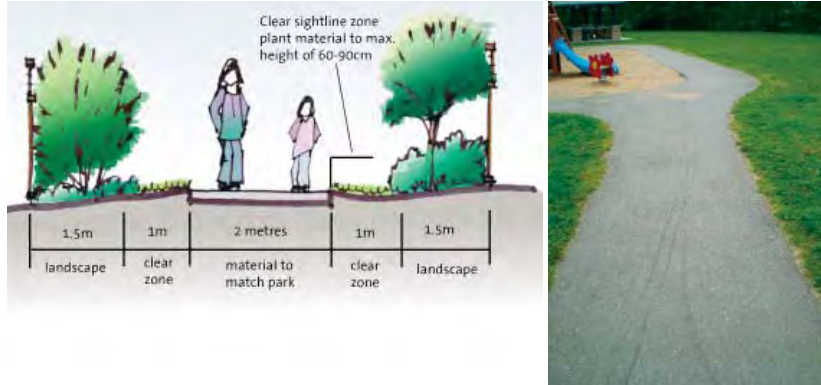
Park Pathways

Characteristic Use: park circulation and connections to facilities

Capacity: varies with width of pathway: high to low

Type of Use/ Accessibility: walking, jogging, cycling, wheelchairs, service access

Location: urban parks



Design Guidelines:

Width: min. 1.8m, varies in location and use

Surfacing: varies, material to match park: asphalt, concrete, road mulch, alternative paving, unit pavers.

Slope: optimum < 10%, cross-slope 2%

Clear Sightline Zone: 0.5- 1.0m width from edge of path; plant material maintained to a maximum height of 60-90 cm.

Landscape treatment: grass, low, soft landscape treatment to a maximum height of 60 cm. The type of treatment shall match existing, preferably with plant material that is native or combination of native and ornamental, non-invasive and non-bear attracting especially in area with known bear habitat and activity.

Universal Accessibility: where achievable (include wheelchair friendly signage).

Barriers at Trailhead: Bollard or Baffle (see Trailheads).

Riparian ESAs: In accordance with City ESA reports and RAR guidelines.

Residential Setback: N/A

Barriers/ Spatial Delineation: Where new trails sections are constructed adjacent to riparian and conservation/environmentally sensitive areas, fencing as accepted by DFO will be installed, with associated landscaping (where appropriate). See example fence detail D19.

Root Barriers: min. 5.0m length centered about the trees for protection, e.g. Deep Root barriers.

Drainage: varies to respond to site situation shallow swale on uphill side, culvert at low points, sheet flow, French drain, center crown, or permeable paving. Geotextile fabric is required on wet and unstable subgrade.

Potential Variation:

- ❖ surfacing may be concrete, asphalt, road mulch, and paver
- ❖ width may vary depending upon site situation, material, use e.g. service access
- ❖ the width of the sightline clear zone may be adjusted to accommodate site specific requirements in order to achieve optimum visual corridors and sightlines

Maintenance: The maintenance level is determined according to a set of criteria - refer to the Trails Maintenance and Operations Section. City contact information is posted for public reporting of maintenance concerns i.e. repairs/damage, trail obstruction, and vandalism.

Recreational Off-Road Cycling/Mountain Biking

Trail and Facilities – Design Guidelines

(Excerpt: *City Of Coquitlam Off-Road Cycling Strategy, 2007*)

Open Space and Linear Parks

Off-road cycling trail users gravitate to trail loop systems. A successful trail system will have a variety of looping trails with varying landscape features and of varying lengths. As illustrated on Network Trail plan, the goal is to provide cycling loops that are suitable for family oriented activities. Pedestrian linkages, neighbourhood trails, regional trails, utility corridors, park/natural area trails and strategic transportation plan bike routes combined to provide a system of north-south and east-west cycling connections.

The establishment of recreational cycling loops provides continuous trail linkages between neighbourhoods, park trail networks, Crown land, transportation hubs, other public amenities, features and commercial. The challenge will be to link areas that are topographically and geographically isolated. The key to future success of this amenity type is to ensure that recreational cycling objectives are included in the planning of new residential, commercial and parkland developments.

Features include:

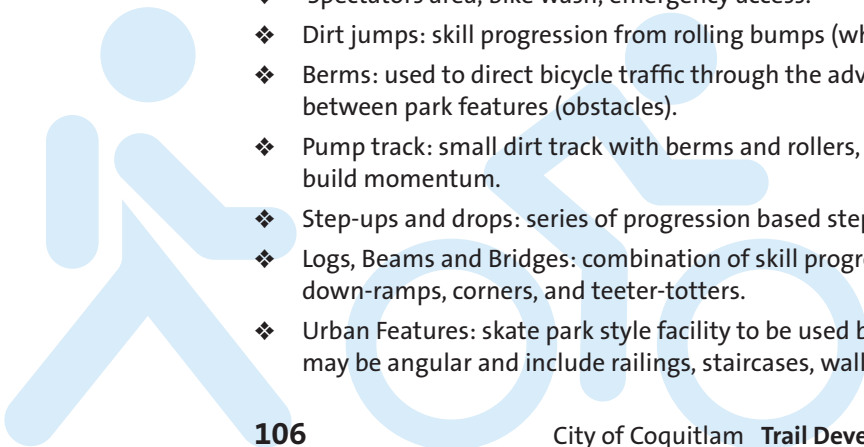
- ❖ Signage: trail maps, description of route types (green, blue, black), trail identification signage, road signage indicating bikes on the road.
- ❖ Trailheads, parkland trails, neighbourhood trails, utility corridors, bike routes, bike crossing infrastructure, Information Kiosks (maps), new trail construction linking key bike routes, end of trip facilities in residential, commercial and parkland developments.

Adventure Park Facility

The Adventure Park Facility is intended to be a small scale neighbourhood facility (similar to a playground), potentially located in any city park. The focus of adventure parks is to provide skill-graded progression-based obstacles for novice to intermediate riders to practice bike handling skills. Obstacles are predominately constructed out of natural materials such as dirt, wood and rock. Refer to the Trail Solutions: *IMBA's (International Mountain Biking Association) Guide to Building Sweet Singletrack* (2004) and the *Whistler Trail Standards*. See Appendix E. Adventure Park Facilities can have a variety of constructed features. Urban style features can be used by bikers and skateboarders.

Features include:

- ❖ Signage: description of facility features, description of different skill levels (progression), park sponsors (community groups maintaining facility).
- ❖ Infrastructure: parking, change/washrooms, garbage receptacles.
- ❖ Spectators area, bike wash, emergency access.
- ❖ Dirt jumps: skill progression from rolling bumps (whoops) to table top or gap jumps.
- ❖ Berms: used to direct bicycle traffic through the adventure park facility and enhance flow between park features (obstacles).
- ❖ Pump track: small dirt track with berms and rollers, allowing riders to pump their bike to build momentum.
- ❖ Step-ups and drops: series of progression based step up jumps and step down drops.
- ❖ Logs, Beams and Bridges: combination of skill progression features including up-ramps, down-ramps, corners, and teeter-totters.
- ❖ Urban Features: skate park style facility to be used by bikers and skateboarders. Features may be angular and include railings, staircases, walls and pyramids or rounded or bowl like.



Gravity Park Facility

The Gravity Park Facility is a destination free ride mountain bike facility to be enjoyed by Coquitlam and Greater Vancouver residents. The focus of a Gravity Park Facility is to provide smooth flowing downhill-specific skill-graded trails, dirt jumps and bike feature (obstacle) areas. The gravity park will be based upon skill progression allowing novice to advanced riders to practice bike handling skills and ride trails more safely and successfully. Bike specific trails will include technical trail features such as berms, jumps and drops. Refer to Trail Solutions: *IMBA's Guide to Building Sweet Singletrack* (2004) and the *Whistler Trail Standards*. See Appendix E. The Gravity Park will provide a venue for community groups to host downhill, biker-cross and slope-style bike events.

Features include:

- ❖ Signage: description of park features, description of different skill levels (progression), park sponsors (community groups maintaining facility).
- ❖ Infrastructure: parking, change/washroom, garbage receptacles, spectators area, bike wash, emergency access
- ❖ Biker-cross trail: double-track with berms and jumps allowing riders to compete side by side.
- ❖ Single track trail: combination of different skill level trails. Features in single track trails may include bermed corners, jumps, drops and log bridges.
- ❖ Slope-Style Area: intensive development area similar to the Adventure Park Facility. Combination of berms, jumps, and natural / non-natural jib features.
- ❖ Emergency Access Road: provides access for spectators, emergency vehicles and service vehicles.
- ❖ Pump track: small dirt track with berms and rollers, allowing riders to pump their bike to build momentum.
- ❖ Uphill trail: all trails in the Gravity Park Facility will be downhill specific with the exception of this trail.

Trail Network Park

The objective of the Trail Network Park is to provide a variety of cross country type skill-graded trails with a focus on skill progressions where novice to advanced riders can practice riding naturally built-up trails. Trails may include technical trail features constructed out of natural materials such as dirt, wood and rock. Trail Solutions: *IMBA's Guide to Building Sweet Singletrack* (2004) and the *Whistler Trail Standards*. See Appendix E. The trail network park will provide a venue for community groups to host short cross country or criterium type competitions.

Features include:

- ❖ Signage: trail map description of trail types, description of different skill levels, (progression), individual trail signage, park sponsors (community groups maintaining facility).
- ❖ Infrastructure: parking, changing rooms/washrooms, emergency access, garbage receptacles, bike wash.
- ❖ Central access or perimeter trail: double-track trail providing connections to different network trails and access for emergency response or maintenance crews.
- ❖ Single-track trails combination of different skill level trails. Technical trail features such as logs bridges, teeter-totters etc. will be incorporated into trails. Trails may include different skill level features options.
- ❖ Technical trail feature nodes: intensively built up areas where trails merge and diverge.
- ❖ All technical features to enhance natural setting of park and reduce environmental impacts associated with mountain biking (enhance natural features such as nurse logs, downed trees, wet areas). Refer to Appendix D for more detailed information.

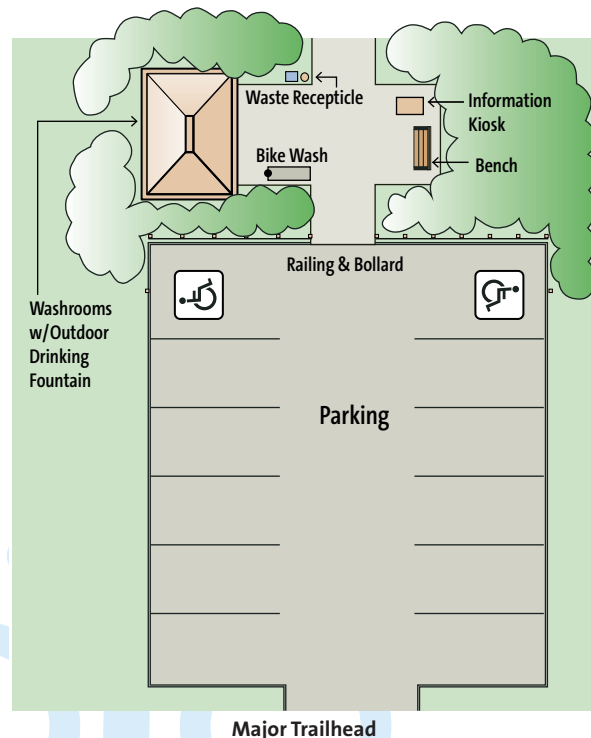
Trail Development Guidelines

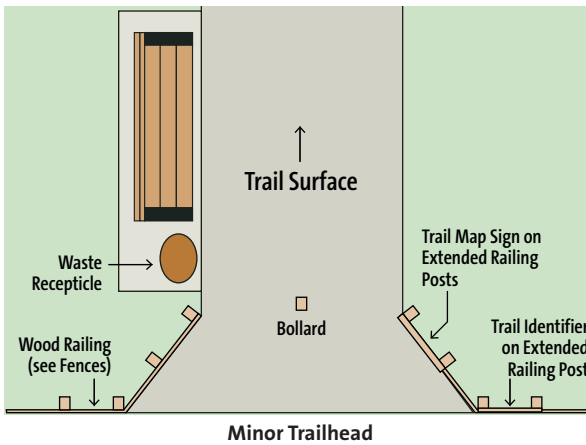
Trailheads

As access points to trail, trailheads typically occur at roads, or near parking lots within parks. The Trail Network Plan identifies the locations of existing and proposed trailheads. Consistency in the design of Trailheads can help to establish an identity for the City's trail system and help in way-finding. This is also promoted as a CPTED principle where trail entries should typically be well defined and pedestrian friendly with direct connection to the public sidewalk or to the curb with consistent trail signage to ensure people know they are walking into a sanctioned public trail.

There are three general categories of Trailheads which are implemented depending level of services required. The specific head designs will also respond to site specific requirements to guide the ultimate layout and practical requirements. Some conditions to consider would include soils, slopes, views, vegetation, interpretive opportunities, adjacent land uses and features. Trailheads in forested areas, near riparian corridors and other areas in the Northeast may require additional fencing, signage and educational information in areas close by active bear/wildlife habitat.

1. **Major Trailheads** – are provided at strategic points where parking can be provided and there is a high demand for trail use. Major trailheads may coincide with community or citywide parks or school/park sites, as parking is often available at these park site. These trailheads provide an area for groups to meet and for trail users to plan their route so mapping is a requirement. Amenities such as benches, drinking fountain, trash receptacles, and washrooms should be provided. Others may include parking, roofed kiosk for signage, trail maps, gathering area of the trail surface material or paving, bench(es), interpretive kiosk, washrooms or bicycle washing station.
2. **Minor Trailheads** – do not include dedicated parking lots but may include street parking. These trailheads are smaller in scale and typically include fewer facilities such as a bollard, trail identifier/trail map sign(s), waste receptacle (optional) and railing/fencing.
3. **Trail Entries** – at minimum will have signage, railing and bollard/barrier as required to control unauthorized vehicular access. Variations may include arbours and speciality stone work and signage associated with a particular neighbourhood or subdivision development style. e.g. Smiling Creek Neighbourhood.





Off-Road Cycling Staging Area/Trailheads:

Similar to Major Trailheads recommended elements would include parking, changing rooms/ washrooms, garbage receptacles, bike wash, and information kiosk. Updating existing park entry and/or Trailheads to include multi-use staging facilities (biking/hiking) are options to minimize costs.

General Information to be available would include trail map, description of trail types, description of park features, description of different skill levels (progression), facility sponsors (community groups maintaining facility), current events calendar (upcoming races or trail maintenance days) or community information bulletin board.

Trailhead Location Criteria:

Locate major Trailheads where there is high use, good visibility, parking and washroom facilities. Locate minor Trailheads at road crossings and in park areas that do not have parking lots. Trail entries include all other access points into the trail system.

Potential Variation:

Use baffles instead of bollards on nature trails where bicycle use is not permitted and at major road crossings or other locations where cyclists are encouraged to dismount.

Public Washroom Location:

- ❖ Washrooms shall be located so there is a line of sight to adjacent land uses, to and from the parking lot and Trailhead.
- ❖ Washroom designs and types(single or multi-client use) will be determined according to specific site requirements.
- ❖ At major trailheads, where possible provide wheel-chair accessible permanent or portable washrooms.
- ❖ Washroom access doors shall be oriented to provide optimum surveillance from supporting activities and land uses.
- ❖ Single entry doors with or without maze components avoids double entry (Man trap) style washroom doors.
- ❖ Incorporate wire mesh openings at the tops or bottoms of doors to allow calls for assistance to be easily heard.
- ❖ Landscaping shall be kept at 60 cm distance away from doors and windows. It shall have a maximum mature height of 60 cm.
- ❖ Lighting shall be considered according to site specific requirements. Lit facilities that are visible from the street, observable from adjacent land uses and people, do not attract loitering and other nuisance behaviour. If lighting is required in more isolated or remote areas, a timed sequence to shut off after hours shall be considered.
- ❖ Provide contact information signage on or near washrooms so the public is able to report maintenance or vandalism issues.



Visibility:

Sightlines to and from the Trailheads will be maintained by providing a clear open access portal, and permeable barriers. Planting at the Trailheads and entry portal shall be native or combination of native and ornamental, non-invasive, non-bear attracting and will be a maximum of 60 cm high at maturity.

Angle trail access points to provide a more open access portal and open sightlines in and out of the Trailhead and entries.

Trail Signage:

Provide trailhead signage that includes trail name, trail regulations and permitted uses, site/trail map and city contact information. Incorporate signs into railings where possible to minimize the number of posts and structures.

Other considerations:

- ❖ Direction/distance markers should be included at major trail crossings and Km intervals.
- ❖ Interpretative signs should be located at points of interest and rest areas.
- ❖ Along trail corridors signage shall communicate: trail hazards, pedestrian crossings at intersections, bike speed limits and permitted trail user groups.
- ❖ Signage placement shall be prominent but not obstructive.
- ❖ Trail signs shall have an anti-graffiti coating.



TAC and regional wayfinding guidelines to apply where the recreation trail is integrated as part of the citywide and regional cycling network.

Trailhead Parking:

At Trailheads of universally accessible trails, provide designated parking stall(s) for persons with disabilities according to relevant city bylaws.

Ensure adequate setback for door opening of 0.5-1.0m between any fence and rail and the accessible parking space. Keep a clear sight corridor between 60cm and 2.5m from grade.



Ensure clear sight lines are maintained. Low planting is appropriate adjacent to parking stalls to a maximum mature height of 60 cm.



Trail Slopes

Accessibility should be considered in the design and maintenance of all trail types where feasible. Most importantly with those that accommodate a high volume and variety of users such as with Urban Multi-use and Park Pathways trail types as well as Urban Nature Trail and Trail Connector. Universal accessibility standards may not be achieved where trails occur on steep and varying terrain, particularly Nature Trails without incurring high cost and causing severe environmental impacts.

Rating:

Signage shall be placed at trail entry points to indicate if a trail is wheelchair friendly.

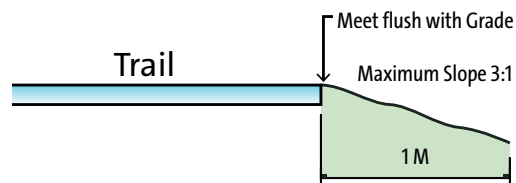
Typical Maximum Slopes:

For long distances, trail slope not exceeding 5% is preferred.

Trails with slopes at a maximum of 8% allowable for wheelchair accessibility, require a landing every 10 meters.

Slopes near Path:

Ensure that the path surface meets flush with grade immediately adjacent to the trail edge. The maximum slope within 1 m is to be no more than maximum 3:1 where possible. (This may not be possible on trails along steep terrain)



Curb Cuts:

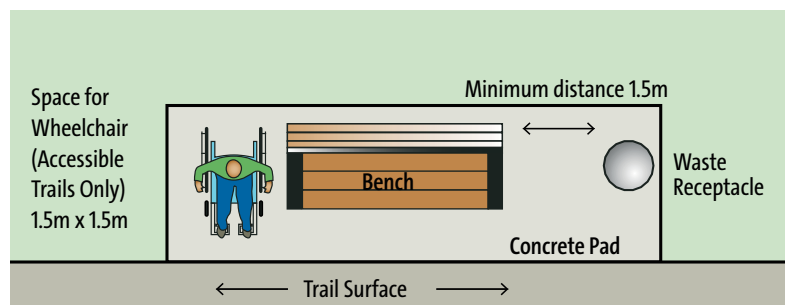
Provide curb cuts where a path crosses roads and from parking for persons with disabilities to access trails.

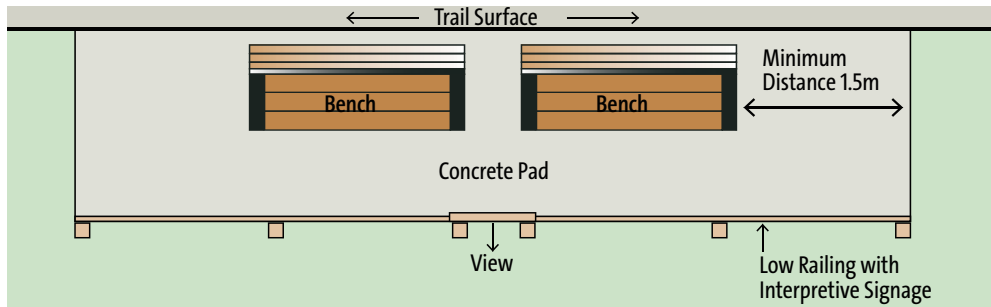
Rest Areas and Seating

Rest areas along trails provide opportunities for sitting, socializing, viewing, education, interpretation and other related activities.

The sketches provide examples of two typical rest areas: a simple bench stop and a viewpoint. The design of rest areas will vary based on site-specific conditions such as soils, slope, views, vegetation, interpretive opportunities, and adjacent land uses and features.

Rest area guidelines are applicable to all types of trails, except that along nature trails there may be fewer rest areas, and they will likely be built to a more rustic standard.





Minimum Typical Facilities:

1.5 x 2.0m - Concrete pad (except on Nature Trail), bench, (if required and accessible for maintenance)

Optional Additional Facilities:

Larger paved area or deck, additional benches, roof over bench, interpretive sign, railing at steep slope, directional sign/map, bicycle rack, landscaping.

Location:

Locate rest areas generally 500 m apart except along Nature Trails, where the spacing may be greater.

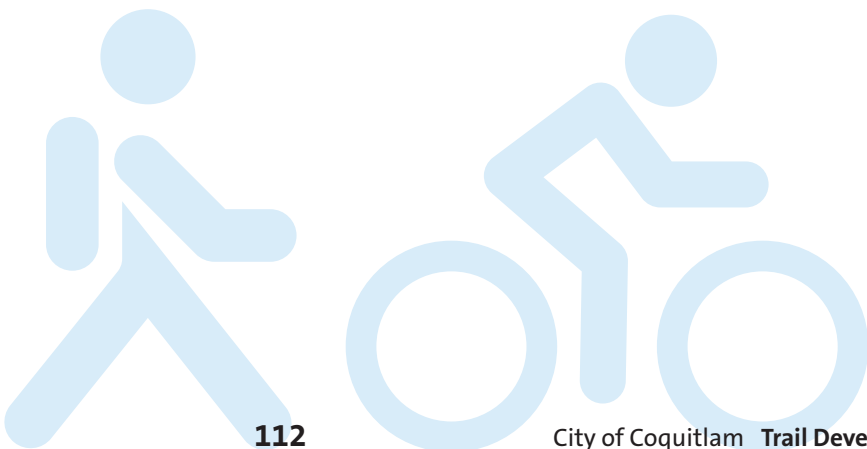
Locate major rest areas at natural viewpoints, major use areas, primary Trailheads, or other nodes based on site-specific opportunities.

- ❖ Locate rest areas or points of interest lookouts where there is opportunity for surveillance to adjacent land uses. Rest stops and points of interests shall have clear sight lines to and from trails.
- ❖ Benches located where they back along trail should be set 1.0m from the trail and/or could be installed at a lower grade to provide sightline back along the trail.

Furnishings:

Variation in standard seating style may be considered for site specific situations where potential or history of nuisance or criminal behaviour may exist.

- ❖ More rustic design along nature trail, e.g. large log seat next to trail, no concrete
- ❖ Different design for viewpoints depending on site
- ❖ Bench design that discourages inappropriate and nuisance behaviours e.g. skateboarding, reclining, sleeping, and other forms of vandalism
- ❖ Furniture that incorporates recycled or graffiti-resistant materials
- ❖ Locate waste receptacles near benches if required, otherwise locate waste receptacles away from bench pads at trail entrances

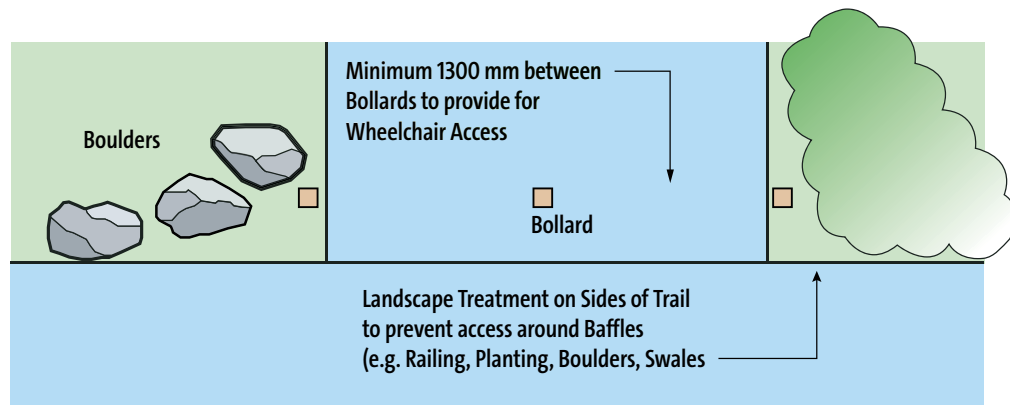
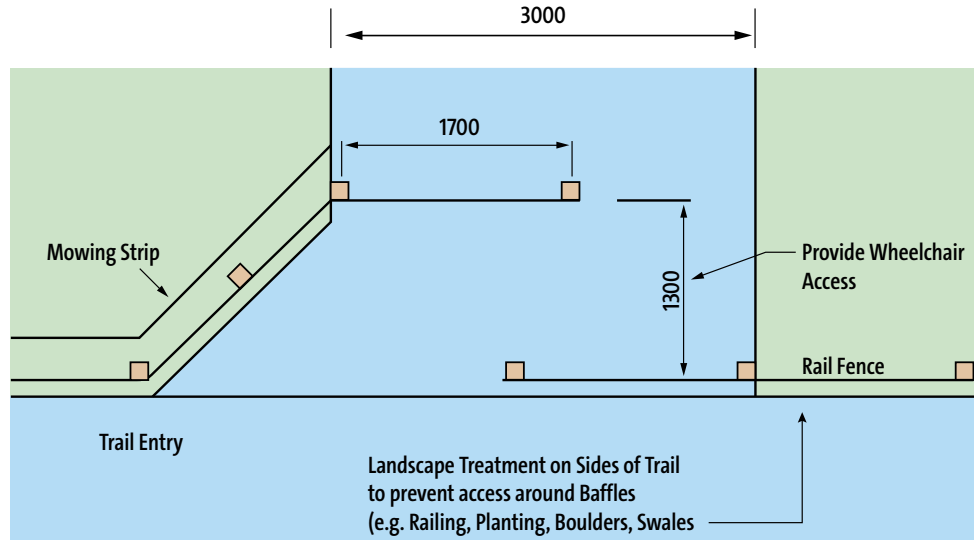


Barriers and Fences

Bollards and Baffles:

Bollards and baffles should be designed and spaced to permit wheelchair passage but to prohibit unauthorized vehicular passage. Some bollards and baffles are to be removable to allow for service vehicle or equipment access.

Ensure that spaces between bollards, baffles and other barriers are sufficient to allow passage by wheelchairs on universally accessible trails. Min. 1300 mm clearance.



As stated elsewhere in this document, bollards are to be used in most trailhead locations. Chains between bollards are not permitted. Generally, metal bollards should be used in more urban environments. Wood bollards should be used in more natural settings or where a wood fence or railing is used at a trailhead. Baffles should also be constructed of metal in more urban areas and of wood only in more natural areas, in keeping with the surroundings.

Baffles are to be used instead of bollards on nature trails where bicycle use is not permitted, where control of motorized vehicles is required, and at major road crossings or other locations where cyclists are encouraged to dismount.

Requirement and placement of bollards and baffles along road side multi-use pathways and cycle routes need to be considered carefully. Improperly sited bollards or baffles can create hazards for cyclists if placed in their natural travel path or are painted in a dark colour that is not easily seen. Reference TAC or AASHTO cycling guidelines regarding best practices on their use and placement.



Fences:

Various options for fence designs and standards are available to provide privacy, protection of ESA's, trail marking and orientation, visual and physical delineation and hierarchy to public and private space. They can also complement the form and character of an area. Visually permeable barriers are appropriate where increased surveillance and visibility are required.

A form of spatial definition marking public and private space will be required along the trail system adjacent to residential property. Where new trail sections are constructed by the City adjacent to riparian and conservation/environmentally sensitive areas, fencing as accepted by DFO will be installed, with associated landscaping (where appropriate). See example in Appendix A.

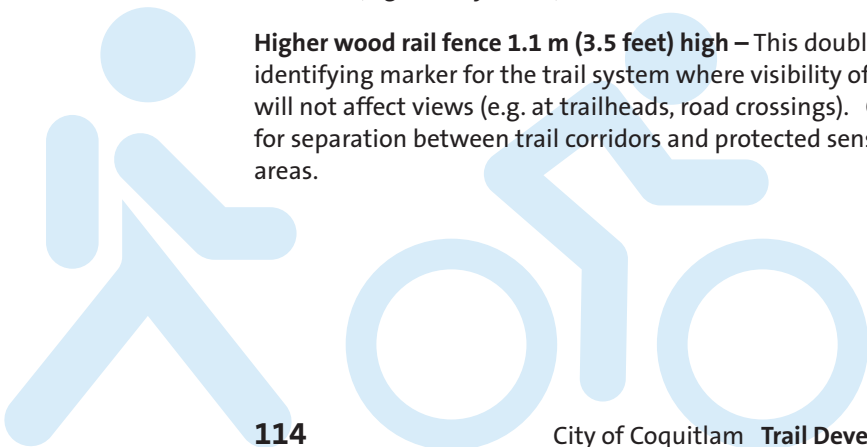
The types of barriers and their locations are as follows:

Black vinyl-coated chain link fence 1.8 m (6' high) – This fence will be used along environmentally sensitive areas that have the most sensitive resources, where any access by humans could negatively affect the resources. The purpose of the fence is to serve as a barrier. Black is proposed to blend with the surroundings. The purpose of galvanizing is durability. The use of this fence should be limited to only the most critical environmental resources and where there are major safety or access issues.

This fence type will be used in known bear habitat and high bear activity areas to help limit wildlife interaction. Its ultimate placement, in context and scale to other elements requires careful review and planning so as not to create dangerous or trapped situations for residents, trail/park users as well as bears and other wildlife.

Low wood rail 0.6 m (2 feet) high – This railing functions as a visual barrier. It will be used to identify a property line between public and private realm or a particular use (e.g. no dogs allowed, top of slope at a viewpoint, edge of parking area) where restricting access is not a major issue and aesthetic quality is of some concern. A potential variation on this railing is wire mesh on the back side in locations where access by dogs or wildlife under the railing needs to be curtailed (e.g. Mundy Creek).

Higher wood rail fence 1.1 m (3.5 feet) high – This double rail fence will be used as part of an identifying marker for the trail system where visibility of the railing is important and the height will not affect views (e.g. at trailheads, road crossings). Chainlink mesh backing may be required for separation between trail corridors and protected sensitive conservation and environmental areas.





Wood privacy fence maximum 1.5 m (5 feet) high – This style of fence is an option for fencing on private property where residential land is close to a trail. Guidelines for the fence include:

- ❖ Provide low planting (to maximum height of 60 – 90 cm) between the fence and edge of trail of the fence where possible.
- ❖ Include permeable or semi-permeable features in the fence, e.g. lattice at top, baffles.

Variation along long stretches of fence is recommended, e.g. stepping top of fence, notches to accommodate planting.



**Top left: Vinyl-Coated Chain Link Fence; Top right: Higher Wood Rail Fence;
Bottom left: Low-Wood Rail Fence; Bottom right: Wood Privacy Fence**

Hedging and Mass Planting:

A row or mass planting of shrubs, in combination with a fence or rail, can be a soft, effective barrier. It will create a layered transition from private to public. The use of appropriate plant material can achieve effective buffers between residential property and public trail corridors e.g. use native, combination of native and ornamental, non-invasive and non-bear attractant plant material. This helps to deter trespassing.

Property Definition:

Where new trails sections are proposed for construction by the City adjacent to existing residential homes and where there is no existing privacy delineation in place on private property, the City will follow applicable CPTED principles and recommendations. In consultation with property owners, agreed appropriate action may include no action, installation of visually permeable hedging, or privacy and safety fencing (to city standard and according to CPTED principles and standards, installed on private property), along with associated landscaping (between trail and property line).

Gates:

Typically, there will be no need for gates along the low and higher wood rail fences. Locking gates should be located within the black chain link fence as required to satisfy monitoring and maintenance requirements. Locking gates should be a part of a wood privacy fence where appropriate to allow passage from private property to the public land. Where fencing abuts private property it is recommended that signage identifying private land be installed.

Tree Protection

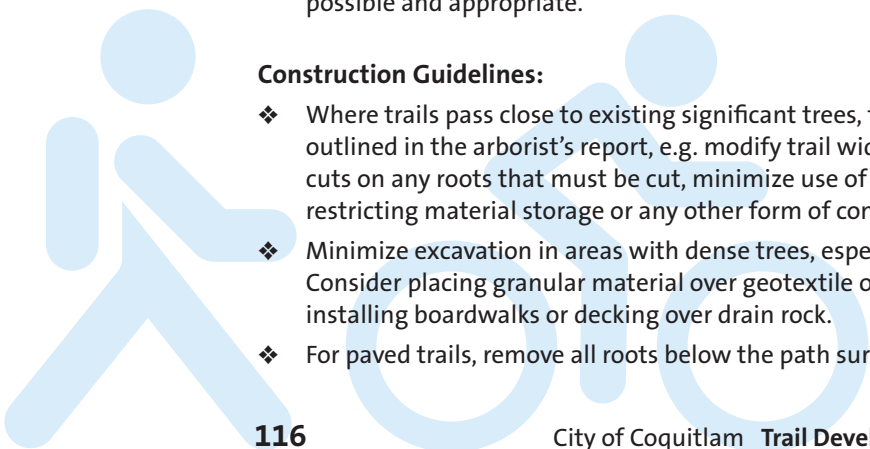
Trees are important resources that add aesthetic and environmental value to the areas surrounding the trail system. Care should be taken to protect trees wherever possible in the planning, design, construction and maintenance of the trail system.

Design Guidelines:

- ❖ Route trails around the drip line of existing significant trees where possible.
- ❖ Standard trail widths may be adjusted to minimum widths in order to reduce impact to tree root systems. Deviations from typical trail standards may be necessary to suit site/project specific conditions.
- ❖ In densely forested areas, route trails through major gaps between trees where possible.
- ❖ Stake and adjust trail alignment on site prior to finalizing the alignment in order to avoid trees.
- ❖ A report by a certified arborist is required for trails proposed within the drip line of significant trees and/or where there is a risk to life or property.
- ❖ Where trail routes go through treed areas, avoid excavation into root zone. The trail profile may need to be built up from root zone to avoid damage and impact to existing significant trees. Trail routes proposed through tree drip lines will require review and recommendations by a certified arborist.
- ❖ Trim hazard trees to create snags for wildlife instead of removing the entire tree where possible and appropriate.

Construction Guidelines:

- ❖ Where trails pass close to existing significant trees, take measures to protect the tree as outlined in the arborist's report, e.g. modify trail width standard, protective fencing, clean cuts on any roots that must be cut, minimize use of heavy equipment, hand digging, restricting material storage or any other form of compaction over tree roots.
- ❖ Minimize excavation in areas with dense trees, especially for trails that are not to be paved. Consider placing granular material over geotextile over undisturbed existing subgrade; installing boardwalks or decking over drain rock.
- ❖ For paved trails, remove all roots below the path surface in preparing the subgrade.



- ❖ If there are tree roots likely to extend under the path, use a commercial root barrier system to prevent this where required. e.g. Deep Root Barriers.
- ❖ Avoid cuts to tree bark by construction equipment with installation of protective fencing at prescribed offsets (from certified arborist) from tree trunk prior to construction.
- ❖ Consider wind throw hazard if clearing clumps of trees, especially in densely forested areas.
- ❖ Do not change the drainage pattern around existing trees unless approved by the certified arborist .
- ❖ Tree protection fencing to include signage outlining the purpose of the fencing. Do not use living trees for signage posts; signage shall not be attached to existing trees.
- ❖ Do not store or stock pile materials and equipment within the fenced tree protection zone of retained existing trees.

Landscape Treatment

The landscape treatment adjacent to trails will depend on the trail type as well as the surrounding area. Refer to Appendix H for more information on plants to avoid and recommended wildlife friendly landscaping.

Landscaping Along Trails:

All landscape installation and maintenance practices should conform with the BCSLA/BCLNA landscape and city standard. Plant no trees or shrubs within the vertical clearance zone indicated on the trail guideline sheets. Avoid mass planting of tall shrubs near the trail edge where they will overgrow to impede visibility along the trail. Preferably non-invasive native or combination of native and ornamental species are preferred over exotic species particularly in natural or naturalizing areas. Minimize changes to the existing or natural drainage pattern. Do not add or remove excess amounts of water. Ensure that adequate silt control measures and other best management practices are used during construction.



Maintain appropriate sightlines and clearances around facilities, structures, washrooms, parking, edge of trails,

between private properties to allow for easy surveillance; install plant material with a maximum mature height of 60 cm in clear sightline zones. Refer to the different Trail Sections.

In high bear activity areas, appropriate plant material shall be installed that will not encourage and attract bears near public amenities, trails and parks. Non-fruiting trees and shrubs shall be used. Refer to the list of bear attractant plants to avoid and some recommended bear-wise plants in Appendix F as a guide for assembling the appropriate plant palette.

Landscaping in Parks:

Integrate the trail and related landscape with the park design. Consider trees at maturity when planting close to trails and amenities in order to avoid maintenance and security issues. Trees planted at a minimum of 2.0 metres from the trail edge should have root barrier also installed along the trail edge to keep tree roots from spreading close to the trail surface.

Landscaping in Natural Areas:

No new planting will generally be required in natural areas. If planting is required for restoration or screening, use only non-invasive, native species, non-bear attractant plants, especially if close to sensitive bear/wildlife habitat or near active travel corridors. See Appendix F for more detailed plant information. Protection of existing vegetation and brushing within the clear zone

will be the primary management methods. Minimize disturbance to the soil surface and existing vegetation adjacent to trails.

Disturbed areas adjacent to trails will be restored with growing medium (with imported material if necessary) and re-vegetate with non-invasive native groundcover and/or shrubs to match existing. Obtain required permits for any tree removal and trail construction, particularly in riparian and other environmentally sensitive areas.



Landscaping in Utility Corridors:

In utility corridors, comply with the specific limitations of the utility regarding planting.

Along hydro corridors, refer to current Planting Near Power Lines by B.C. Hydro (or any updated brochures). B.C. Hydro requires that trees and shrubs planted within the ROW have a maximum mature height of 3m.

Setbacks along gas or other pipe corridors vary according to the utility company and the type of pipe, e.g. Tree planting within the Fortis Gas ROW is not permitted. Only plant material to a maximum mature height of 1.8m may be to be planted within their ROW corridors with exception of 1.0m on either side of pipelines where only shrub and groundcover to a maximum mature height of 45 cm are permitted. Each utility company should be contacted for their requirements and permits at each location. Generally tree planting setbacks are set to allow adequate access for any required pipe repairs. Plants for wildlife enhancement need to be considered carefully if appropriate.



Landscaping near Residential Areas:

Where trails are close to residential property, provide adequate screening with plant material for privacy and to enhance the quality of the trail, but avoid tall dense thickets to address safety and security.

Reduce the visual impact of hard edges such as fences, retaining walls or extensive paved areas with tree and shrub planting.



Riparian Crossings

Riparian crossings for pedestrian and/or bikes along trails are primarily applicable to the Urban Nature Trail and Nature Trail. It is less likely that the other trail types will cross riparian areas, though they may at times. The type of crossing will depend on the trail width and construction and the width of the stream and riparian gully (high water mark or top of bank). Maximum slopes of crossings should be a consideration and may be governed by trail type.

The examples illustrated in the photographs show standard bridges that have been used in Coquitlam. Bridges are an important feature on trails. In addition to providing access, bridges can function as landmarks, viewing platforms, and in some cases, as a support for utilities such as gas or sewer. Bridges provide opportunities to create interesting and unique features by using a combination of round and milled wood and interesting railing and bracing patterns. All major bridge structure designs and supporting components will require certification whether the structure is premanufactured or design/build.

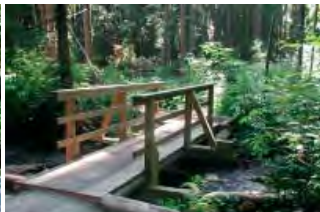
Major Crossings: are generally used along the Urban Nature Trail at significant creeks. A major crossing bridge will be up to 3 m wide with a railing on both sides. The typical bridge deck will be wood with expanded metal lath (0.6 m wide) in the centre to provide an adequate tread in wet weather. More recent installations offer a suitable variation with aluminum and wood. Major bridge crossing designs and support components require certification by a registered structural engineer. Maximum slopes are to be considered according to trail type. For major crossings along Urban Multi-Use Trails where they are integrated as part of the citywide greenway and cycling system TAC guidelines and requirements for professional engineers shall be referenced.

Minor Crossings: are generally used along the Nature Trail, or for very small watercourses along the Urban Nature Trail. The bridge will typically be 2 m wide with a curbed edge. The deck will be wood with expanded metal lath (0.45 m wide) in the centre.

Boardwalks: are generally used in wetland areas where trail routing is required or to minimize disturbance to tree roots or other vegetation in sensitive areas. Boardwalks provide significant opportunities for nature appreciation.



Major Crossing



Minor Crossing



Boardwalk



Wood and Aluminum example at Hyde Creek at David/Glenbrook

Riparian Crossing Design Guidelines:

- ❖ Creek crossing locations should be generally consistent with the Trail Network Plan.
- ❖ Locate major crossings along the Urban Nature Trail at significant creeks (greater than 6 m span).
- ❖ Locate minor crossings along the Nature Trail, or for very small watercourses along the Urban Nature Trail (less than 6 m span).
- ❖ Locate boardwalks in very specialized locations where nature viewing and interpretative opportunities can be provided with reduced impact and damage to the existing environmental resources.

- ❖ Locate riparian crossings at the narrowest point of the creek or gully where possible and in accordance with DFO approval.
- ❖ Construct riparian crossings perpendicular to the creek.
- ❖ Use raised timber edges on low level crossings. Use railings on both sides where the bridge is more than 1.2 m above the water, where the water is deep or swiftly flowing, or where viewing opportunities exist, e.g. salmon spawning.
- ❖ Bridge designs should be built with a potential minimum clearance of 300mm between the bottom of the structure and high watermark of the watercourse.
- ❖ Avoid centre piers on bridges due to potential problems with debris accumulation and environmental impacts.
- ❖ Approaches to crossing decks shall incorporate appropriate footings and wing walls to contain the grade and trail surfacing material.
- ❖ Construction within watercourses requires coordinating notification and approval with DFO through the appropriate municipal review processes. “In-stream” works are generally allowed within set work windows when there is reduced risk to the aquatic resource. The window differs according to the protected species. Coordination with authorities and monitoring of the work is required with the assistance of a qualified environmental consultant.
- ❖ For boardwalks, use a construction method that offers minimal environmental and visual intrusiveness. Consider the use of metal pier supports for boardwalks.
- ❖ Ensure that adequate silt control measures and other best management practices are used during construction to ensure that no silt or construction materials enter the watercourse.
- ❖ As soon as possible after construction, restore disturbed areas with growing medium if possible, and use seed/sod and/or native riparian plants for stabilization.
- ❖ Obtain necessary permits for riparian crossings and boardwalks from the City and appropriate senior government agencies.

Potential Variation:

- ❖ If riparian crossings occur in urban parks, materials of bridge could change to concrete and/or metal in keeping with park design.
- ❖ Construct boardwalks over wetland areas.

Trail Signage

The wayfinding system for recreational off-road trail sections integrated as part of the citywide and Regional Cycling Network will also adopt the Translink regional wayfinding signage standards.

Recreational Off -Road Trail Signage Standards:

There are five main types of permanent signs

1. **Regulatory signs** – indicate traffic regulations, e.g. city bylaw, stop, yield to pedestrians, user etiquette, rules of conduct and use, City contact information
2. **Warning signs** – advise users of potential hazards, e.g. railway crossing ahead, bear/wildlife activity, trail closures.
3. **Park/Trail/Facility Identification signs** – Major park identification signage to include lighting where appropriate.
4. **Orientation and way finding signs** – trail markers or way finding signage indicate routes and facilities, e.g. trail name, bicycle route, bicycle parking, distance to specific destinations, map of trail system indicating current location, context information, directional orientation, slopes, terrain, scale, trail conditions, points of interest, distance, time expectations, trail destinations, etc. Orientation signs should face north for easier orientation unless there are existing constraints.

Trail Construction Guidelines



Recreational Trails

Grading:

Locate trails along appropriate slopes and fit them into the terrain to minimize extensive cut and fill and to protect existing vegetation to the highest degree possible. Refer to Tree Protection guidelines for trails near trees, recognizing that grading can have significant effects on tree health and survival.

Ensure that the Urban Multi-use Trail, Urban Nature Trail, Trail Connector and Park Pathways have sufficient base material compacted to 98% Modified Proctor Density to accommodate trucks, where applicable. Geotextile fabric is required on wet and unstable subgrade.

Drainage:

Construct culverts under trails (except Nature Trail) only where major water flows need to cross the trail alignment. In other locations, construct trails so that water will infiltrate into the swale on the uphill side of the trail. Add culverts in the future only as required.

Drainage design options will vary to respond to site conditions appropriately. Some other design responses include sheet flow, French drain, center crown or permeable paving.

Locate elongated drain grate openings perpendicular to direction of travel and flush with trail surface.

Where culverts are required, use minimum 150 mm poly pipe (larger if required for the anticipated flows). Set at a level that will facilitate drainage. Minimize protrusion beyond the path. A minimum of 150mm coverage is required over culvert pipe; increase to 250 mm where vehicle use is anticipated. Place rocks around culvert ends to hide pipe. Cut ends at a 45 degree angle so that top edge is not an eyesore and a tripping hazard.

Alternate Paving:

Ensure uniform and consistent surface (well compacted for aggregate trails) free of puddles or depressions and obstructions.

New forms of paving are available and may be an alternative to asphalt. These paving materials involve the use of aggregate binders derived from plant byproducts. Unlike asphalt, these binders don't contain petrochemicals, making them suitable for use in environmentally sensitive areas, e.g. soil stabilizers, pervious pavers. Stabilizer paving can be significantly cooler than asphalt because its lighter colour reflects light and reduces heat reradiation. It also can help in stormwater management by allowing drainage through the paving. Refer to Appendix for more detailed information.

Materials for Structures:

All imported lumber should be dimensional cedar or pressure treated Douglas Fir. Fresh cuts to pressure treated lumber should be painted with an appropriate wood preservative. In environmentally sensitive areas, the preservative may need to be applied and allowed to dry a sufficient time before bringing it to the site. Depending on recent research results, it may be necessary to avoid treated wood in ESA's and in high use areas near schools.

Wood walking surfaces should be rough sawn to reduce the slipperiness when wet. Place decking perpendicular to the direction of travel with 10-15mm spacing between boards, and expanded metal lath applied.

The top wood member of handrails should be sanded and beveled as required so the railing can be grasped easily. Where the railing is adjacent to a viewing opportunity it should be rounded or angled to provide for comfortable leaning.

All metal used for fences, bollards and baffles should be of welded construction and powder coated. All metal fasteners should be hot-dipped galvanized. Ensure that fasteners are placed to avoid sharp edges or potential snagging of clothing.

All posts for fences, barriers, bollards and baffles should be set in concrete or gravel footings accordingly to approved design details and site conditions.

Root Barriers:

Paved trails will include installation of root barrier within 5 m of trees in the vicinity. 450 mm minimum deep root barrier installed as per manufacturer's specifications and will extend 5 meters in length centered on each tree. Use City specifications or approved equal.

Retaining Walls:

Avoid the use of retaining walls where possible through careful trail siting and grading.

Do not construct retaining walls where soil creep or surface water seepage is evident. If absolutely required, use well-draining granular backfill and weep holes at the sides and base of such walls.

Consider bioengineering using cuttings of quick rooting native plants on steep slopes, especially if this can reduce or eliminate the need for retaining walls.

Where retaining walls are required in natural areas, avoid using pressure treated lumber products. Use local stone or unit concrete blocks.

Retaining walls higher than 1.2 m should be designed or approved by an engineer.

Steps:

Steps will not be used on the Urban Multi-Use Trail (Multi-use pathways (MUPs), Service and Emergency access) and Park Pathway to be universally accessible.

Use solid timber risers and treads with 450mm width expanded metal lath as the standard step detail on the Urban Nature Trail. Slope treads at 1% for drainage. Collect and disperse water at the top and bottom of steps. Use steps on stringers in high use areas or where rock, sand or roots make it difficult to set steps into the ground. See Appendix A.

The step tread-to-riser ratio should be a minimum of 2:1. The minimum tread width shall be 30 cm, with a riser height of 12 to 20 cm. Ensure a consistent ratio along a set of steps.

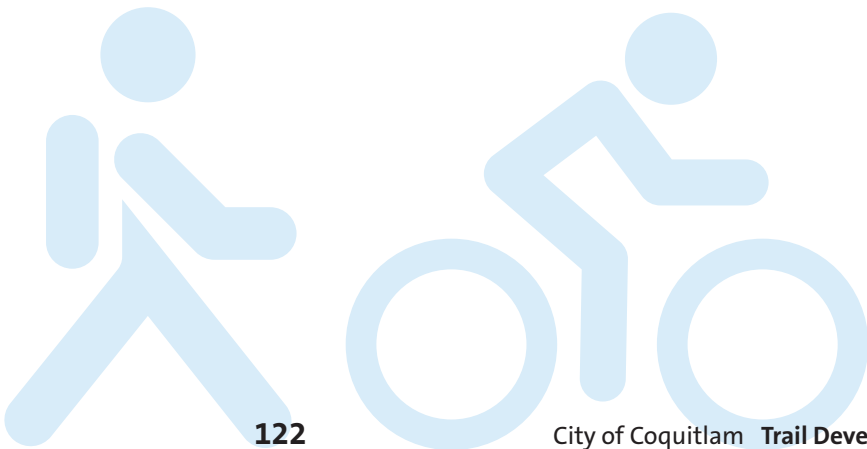
Provide landings between flights of 14 steps or more. Install handrails on at least one side of the steps where flights are steep, long or where there is a 600mm or more side drop to the ground.

Where stairs are necessary, avoid installing a set that is less than 3 steps. Less than 3 can be a tripping hazard.

Select step construction method based on slope drainage and soil. Unstable slopes or poorly draining soils may require specialized footings or anchoring. Constructing on unstable soils may require geotechnical engineering advice.

On the Nature Trail, steps may be more rustic, formed from pieces of logs or rocks.

On Trail Connectors, steps may be built with other materials (e.g. concrete) to match other park construction finishes.





Site Furnishings:

The following will be the standard furnishings for benches and waste receptacles, except along Nature Trails, where benches will likely be more rustic, and waste receptacles will not be placed, except possibly at trailheads.

Bench: Frances Andrew, model: B1-1, metal castings: Black

Surface mounted on concrete pads: 2m x 1m x 100mm thick



Bear Resistant Waste Receptacle: BearSaver, model: BE1-P, Black
 mounted on concrete pad: min. 1.0m x 1.0m x 100mm thick. Double receptacle pad: 1.0m x 2.0m x 100mm.



Bicycle Rack: Frances Andrew, model: E12 – BR1, in-ground mount, Black



Recreational Off-Road Cycling Trail Construction Guidelines

1. Type I and II Trails

Refer to Master Trail Plan Construction Details for Urban Multi-use (comparable to Multi-Use Pathways(MUPs)) and Urban Nature Trails typical section details, or BC Ministry of Forests, Recreation Manual, Chapter 10(2000) when planning, constructing, rehabilitating and maintaining trails.

2. Single Track, Type III, IV and V Mountain Bike Trails

The Provincial Mountain Bike Policy refers trail construction proponents to Trail Solutions: *IMBA's Guide to Building Sweet Singletrack* (2004) and the *Whistler Trail Standards* (see Appendix E for more information) when planning, constructing, rehabilitating and maintaining trails.

3. Technical Trail Features (TTF's)

Man-made Technical Trail Features (TTF) must conform to an engineered standard of minimum strength, stability and construction. Poorly built features are a potential source of injury and increase the need for maintenance. Design, proposed location and construction of TTF's must be authorized and approved by the responsible government official to ensure compliance to construction and safety standards.

Technical Trail Features design principles and construction standards, refer to Appendix II Off-road cycling strategy, for more detailed information.

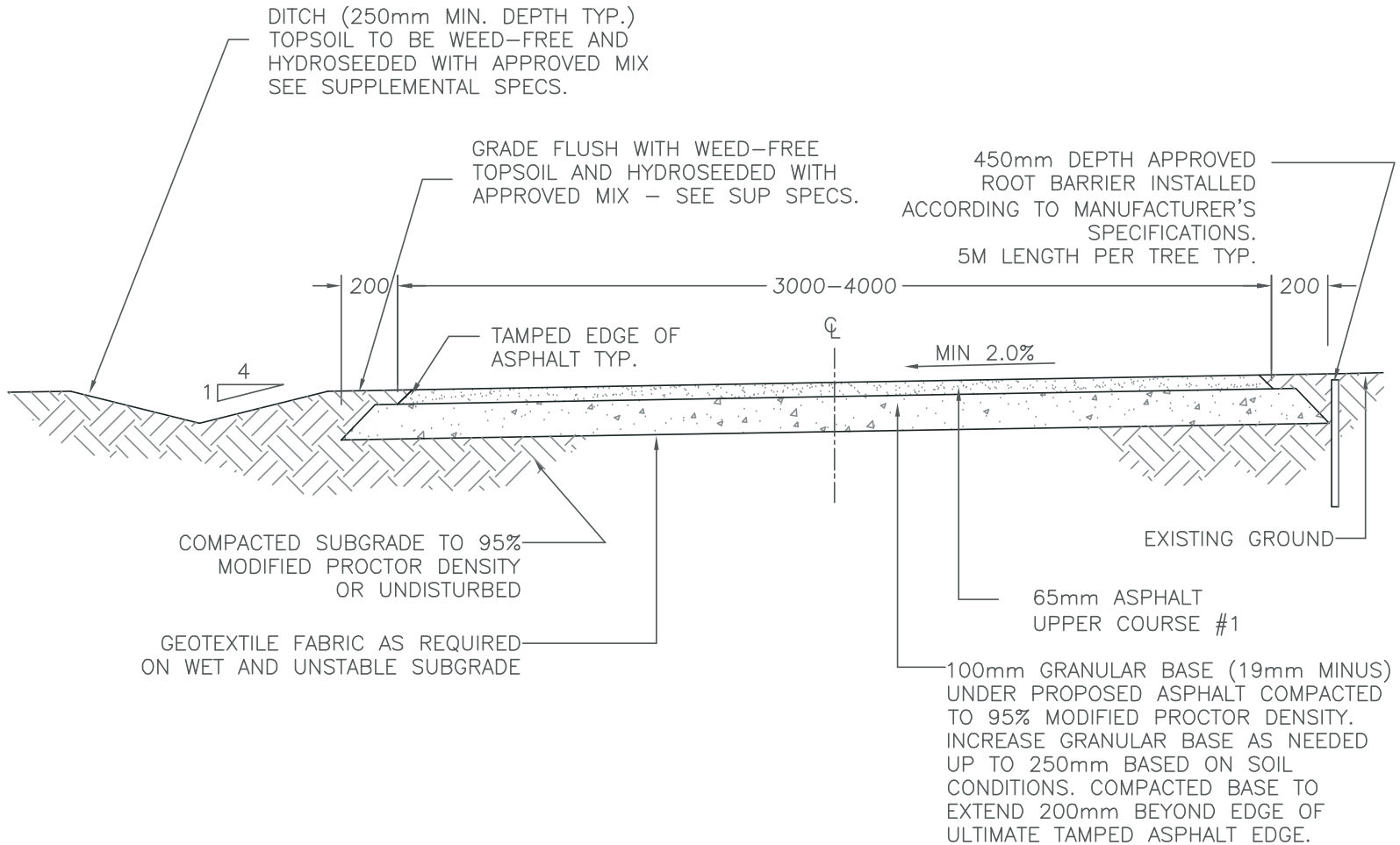
Trail Construction Details

Construction Details

- D1 – Urban Multi-Use Trail
- D2 – Urban Multi-Use / Service Road
- D3 – Granular Service/Access Road
- D4 – Urban Nature Trail
- D5 – Nature Trail - Granular
- D6 – Park Sign/Information Kiosk
- D7 – Park Sign - Interpretive
- D8 – Park Sign – Trail Marker

Trail Marker Placement options – Diagrams 1-4

- diagram 1 – 3 – way intersections
 - diagram 2 – 4 –way intersections
 - diagram 3 – Alternate 3 – Way
 - diagram 4 - Multi-trail Intersection
- D9 – Park Sign – Trail Entry
 - D10 – Bollard
 - D11 – Single Rail Fence
 - D12 – Double Rail Fence
 - D13 – Timber Stairs
 - D14 – Metal Post Chain Link Fenc



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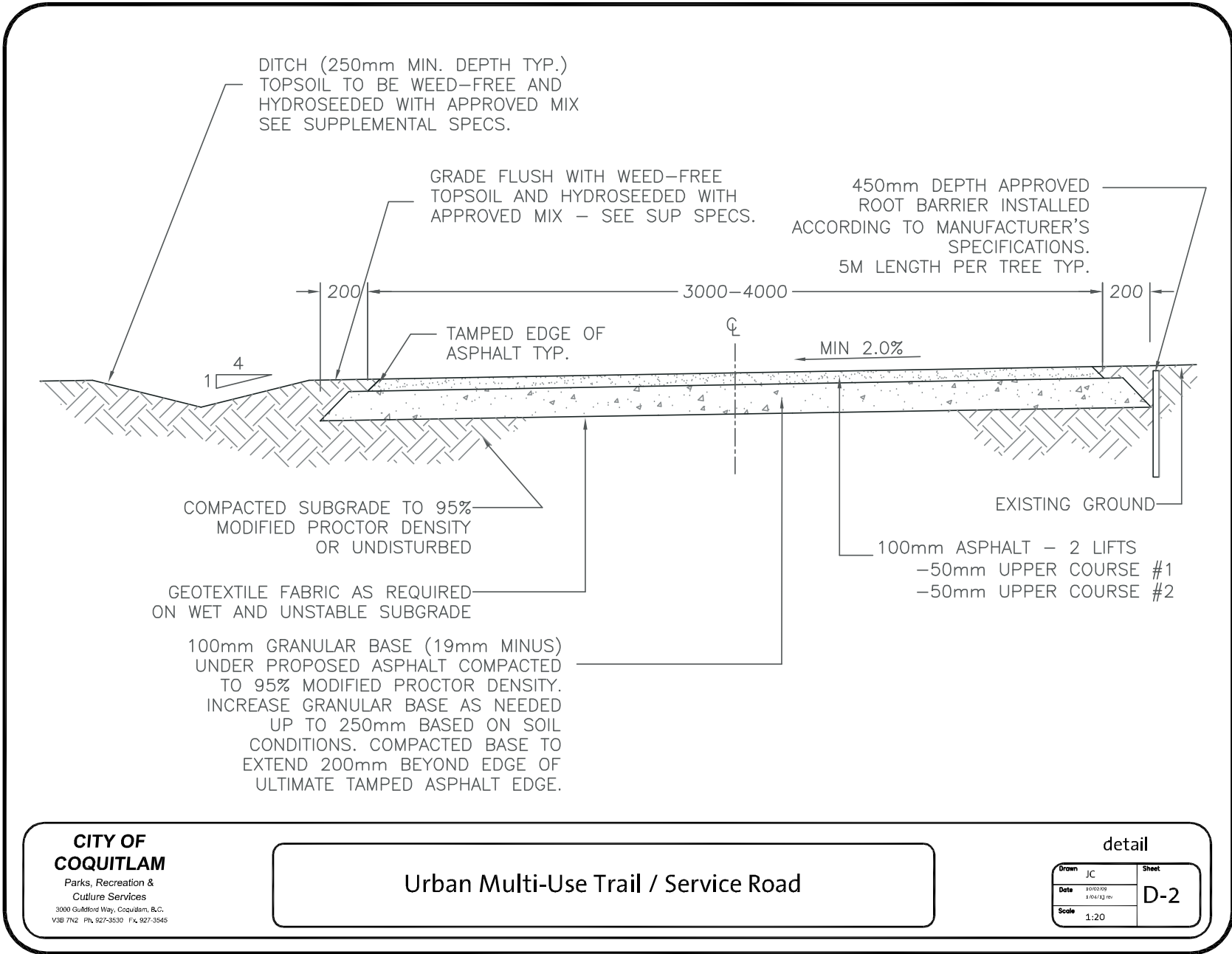
Parks, Recreation & Culture Services

3000 Guildford Way, Coquitlam, B.C.
V3B 7N2 Ph. 927-3530 Fax. 927-3545

Urban Multi-Use Trail

detail

Drawn	JC	Sheet	
Date	10/02/09		D-1
Scale	1:20		



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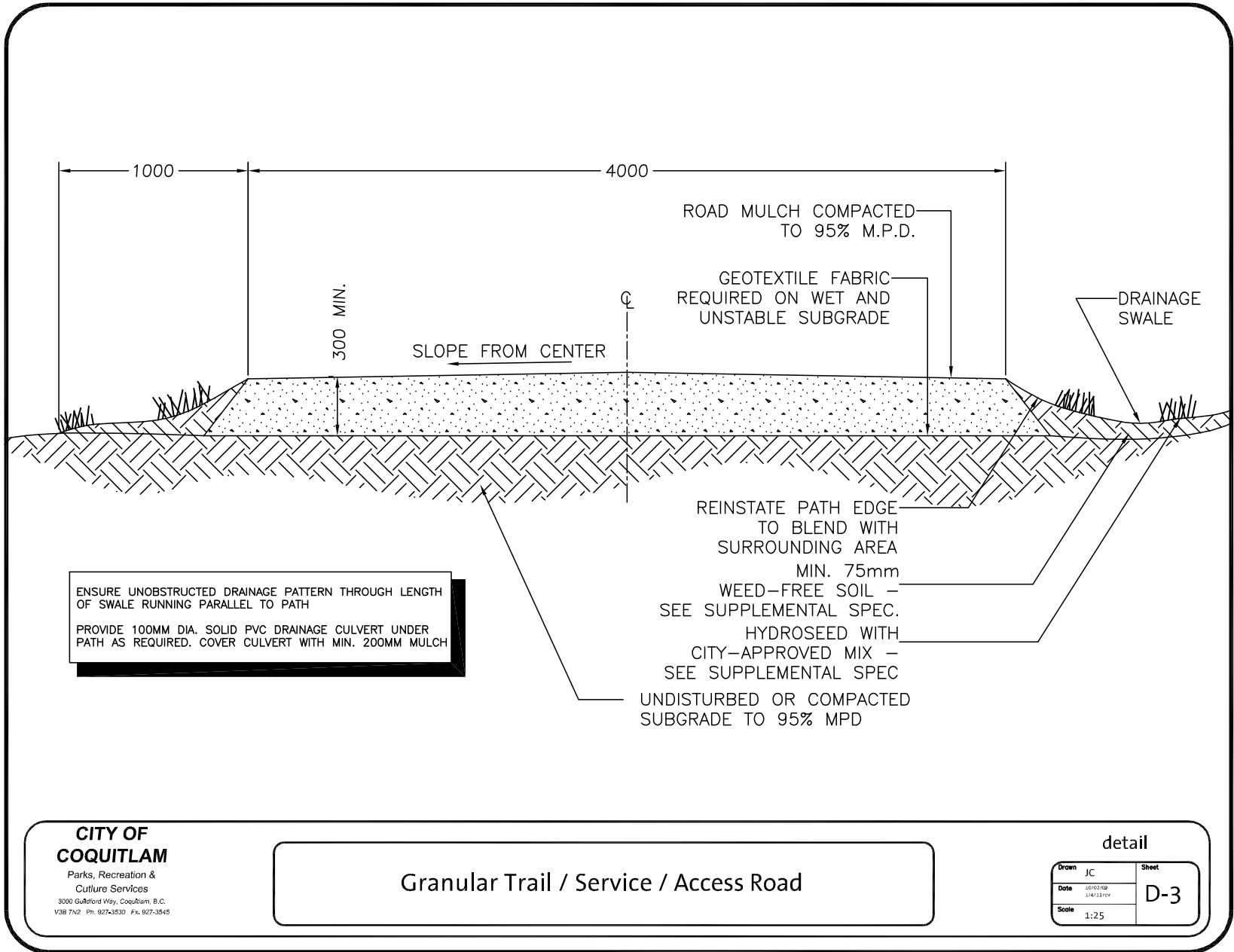
Parks, Recreation & Culture Services

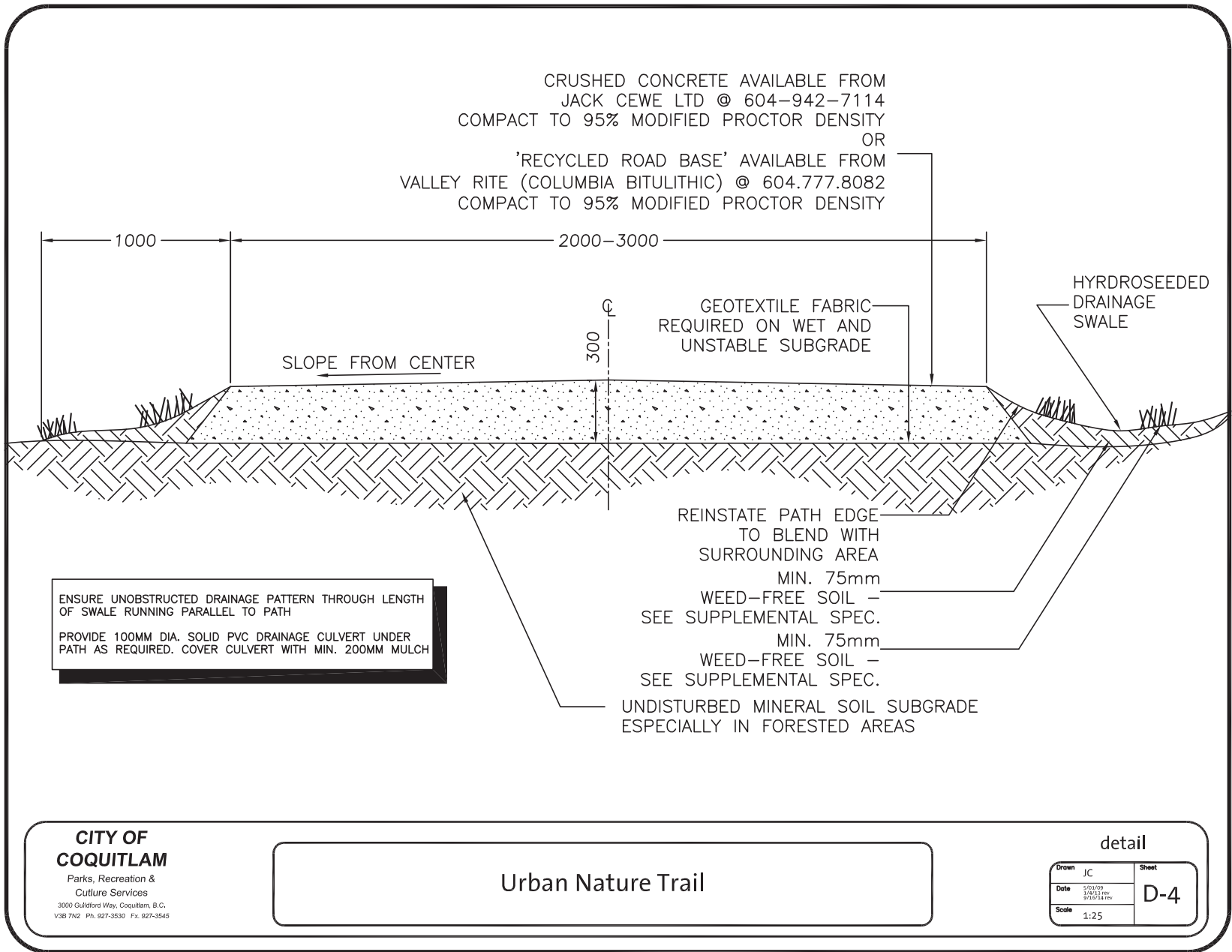
3000 Guildford Way, Coquitlam, B.C.
V3B 7N2 Ph. 927-3530 Fx. 927-3545

Urban Multi-Use Trail / Service Road

detail

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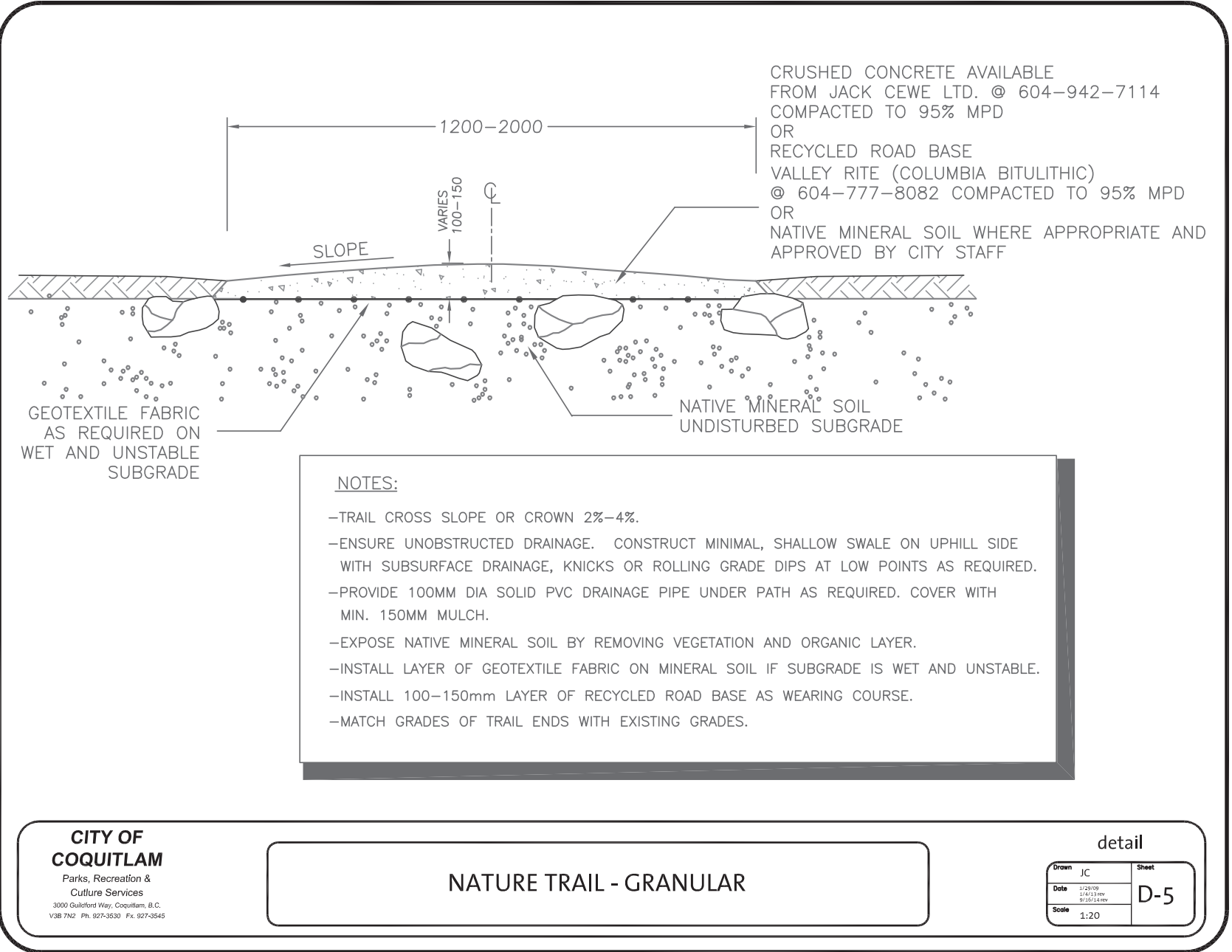
Parks, Recreation &
Culture Services

3000 Guildford Way, Coquitlam, B.C.
V3B 7N2 Ph. 927-3530 Fx. 927-3545

Urban Nature Trail

detail

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Scale	1:25		



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Parks, Recreation & Culture Services

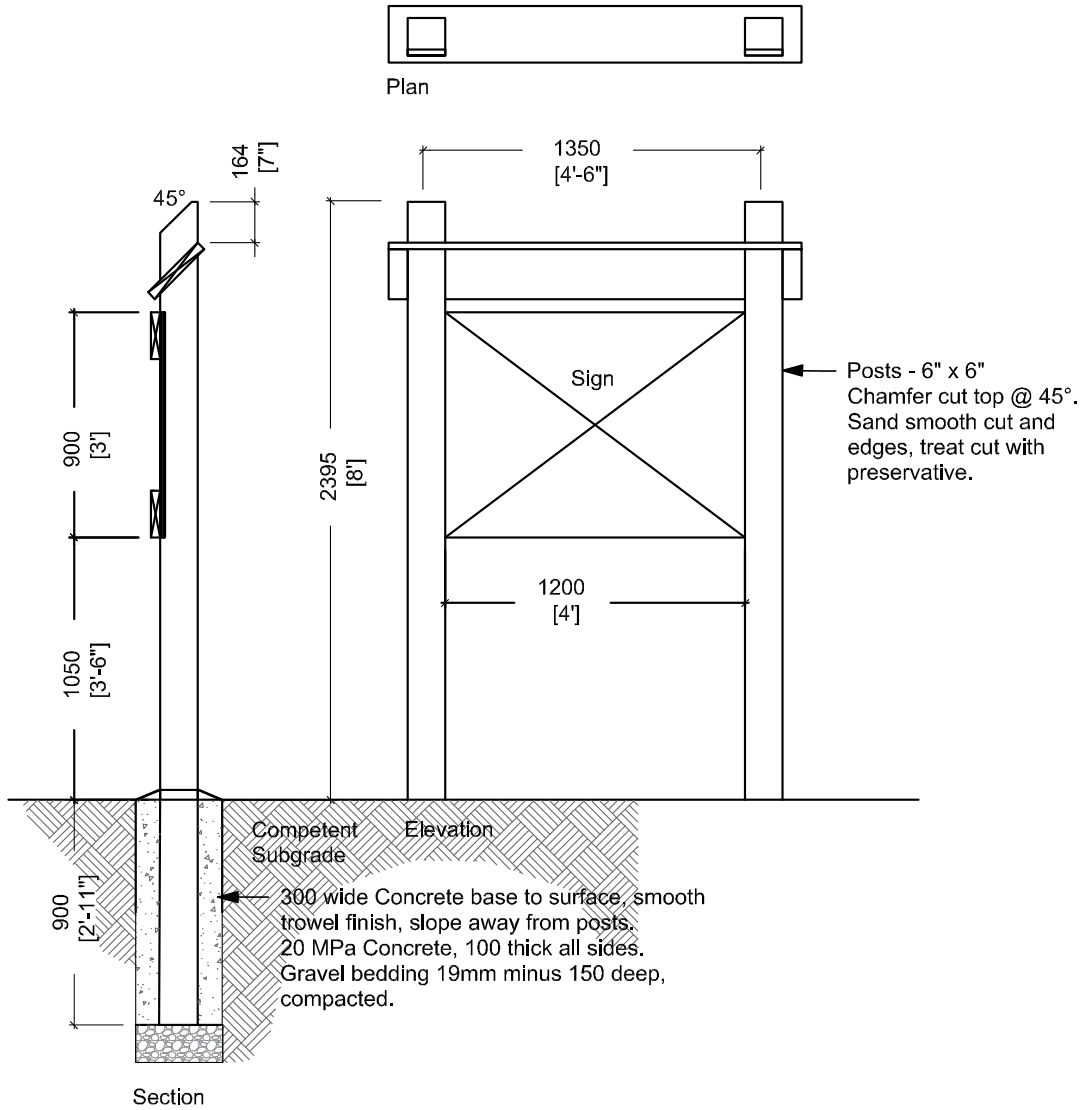
3000 Gulkoford Way, Coquitlam, B.C.
V3B 7N2 Ph: 927-3530 Fx: 927-3545

NATURE TRAIL - GRANULAR

detail

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Date	1/29/09 3/4/13 rev. 9/10/14 rev.		
Scale	1:20		

D6 – Park Sign/Information Kiosk



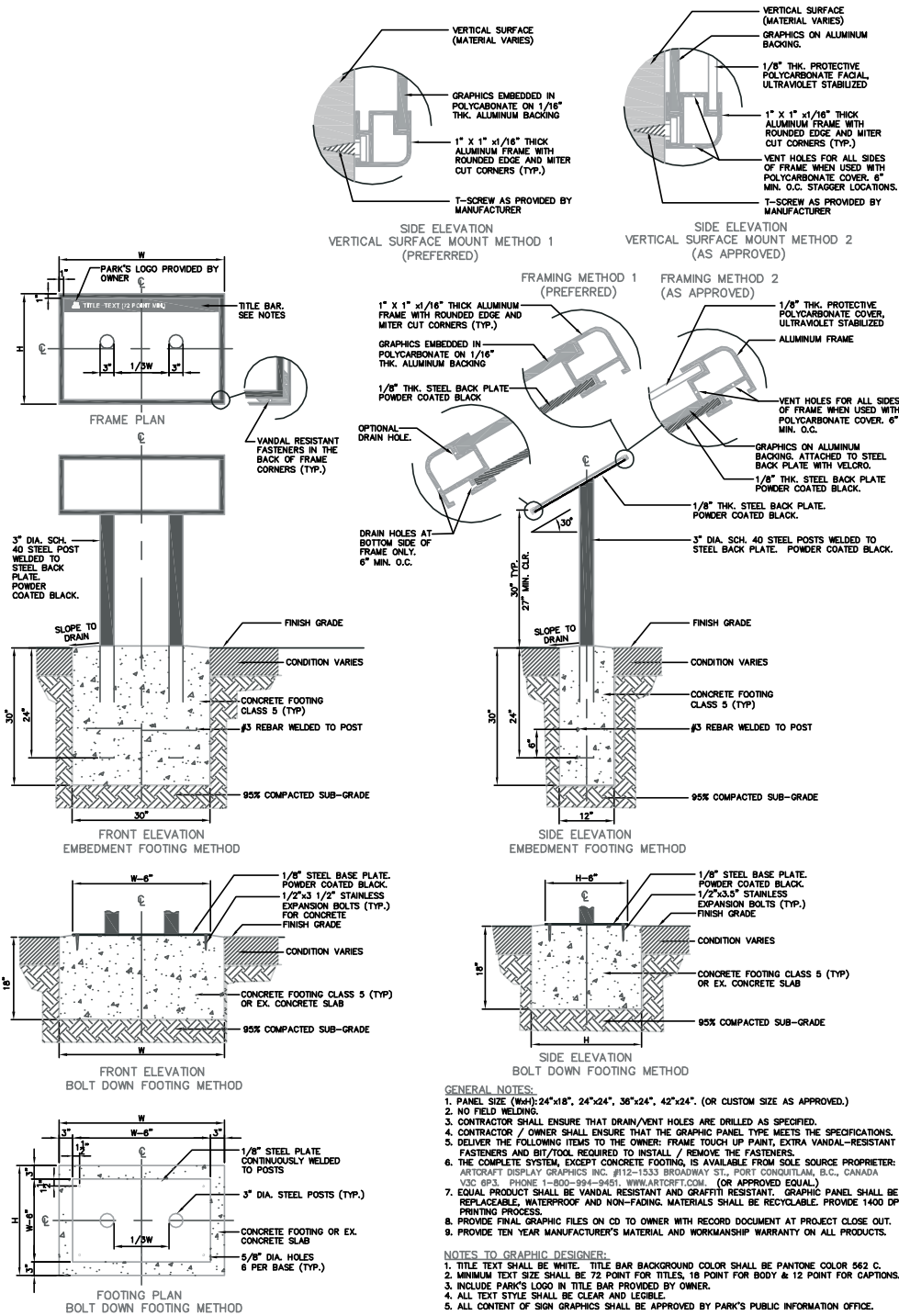
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Culture Services
3000 Guilford Way, Coquitlam, B.C.
V3B 7N2 Ph: 927-3530 Fx: 927-3545

Park Sign / Information Kiosk

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Date	Jan 19, 2012	D-6
Scale	NTS	

D7 – Park Sign - Interpretive



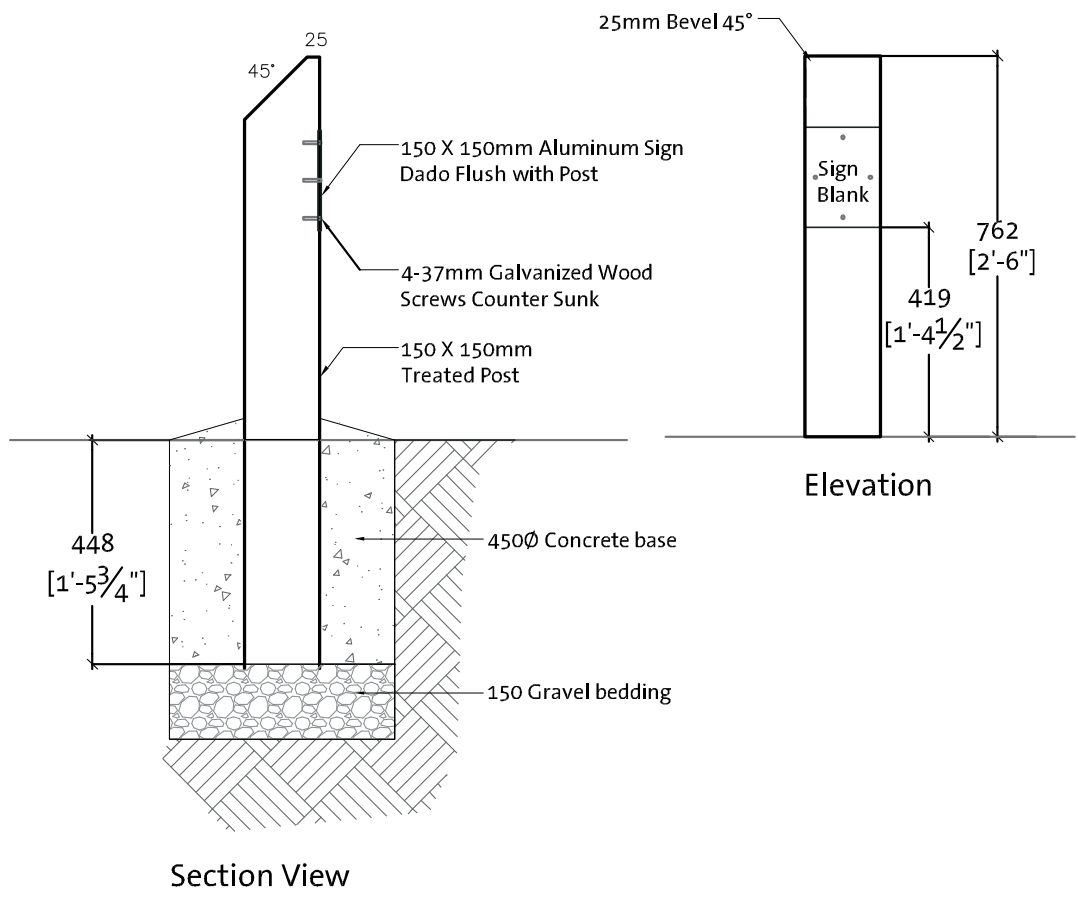
CITY OF COQUITLAM

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3000 Guilford Way, Coquitlam, B.C.
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Park Sign - Interpretive

Drawn	AM	Sheet
Date	Jan 19, 2012	D-7
Scale	NTS	

D8 – Park Sign – Trail Marker



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Park Sign - Trail Marker

Drawn	AM	Sheet
Date	Jan 19, 2012	D-8
Scale	NTS	

Diagram 1 – 3 – way intersections

Diagram 1.
Trail Marker Placements at 3-way intersection.

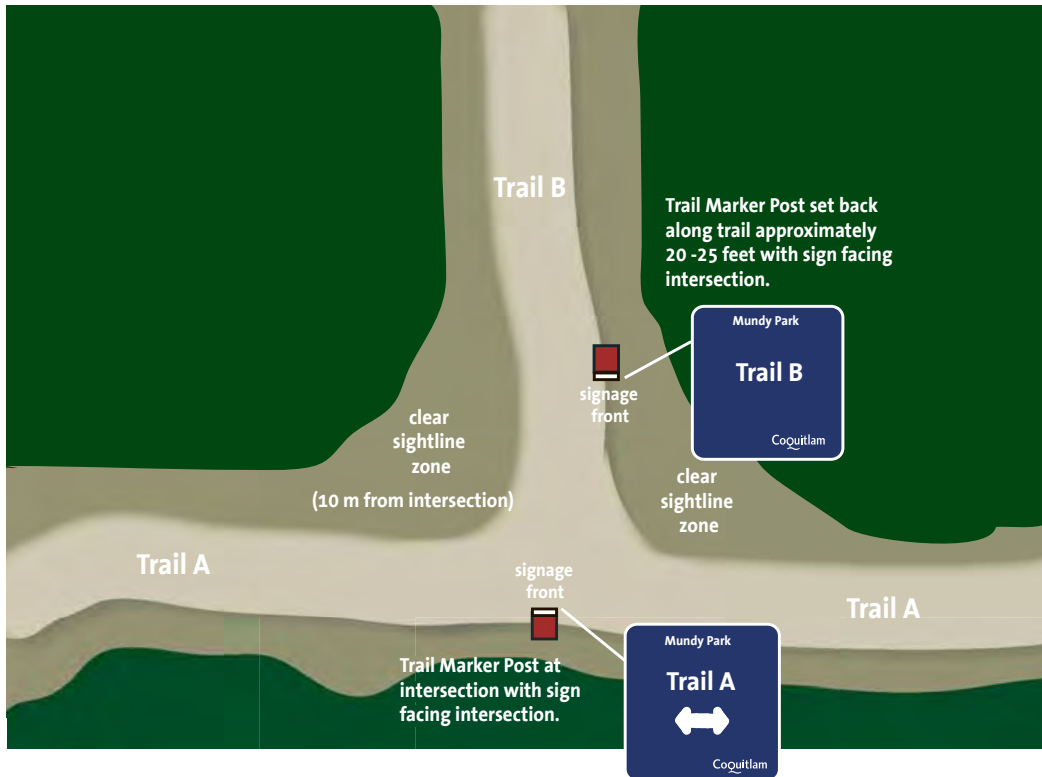


Diagram 2 – 4-way intersections

Diagram 2.
Trail Marker Placements at 4-way intersection.

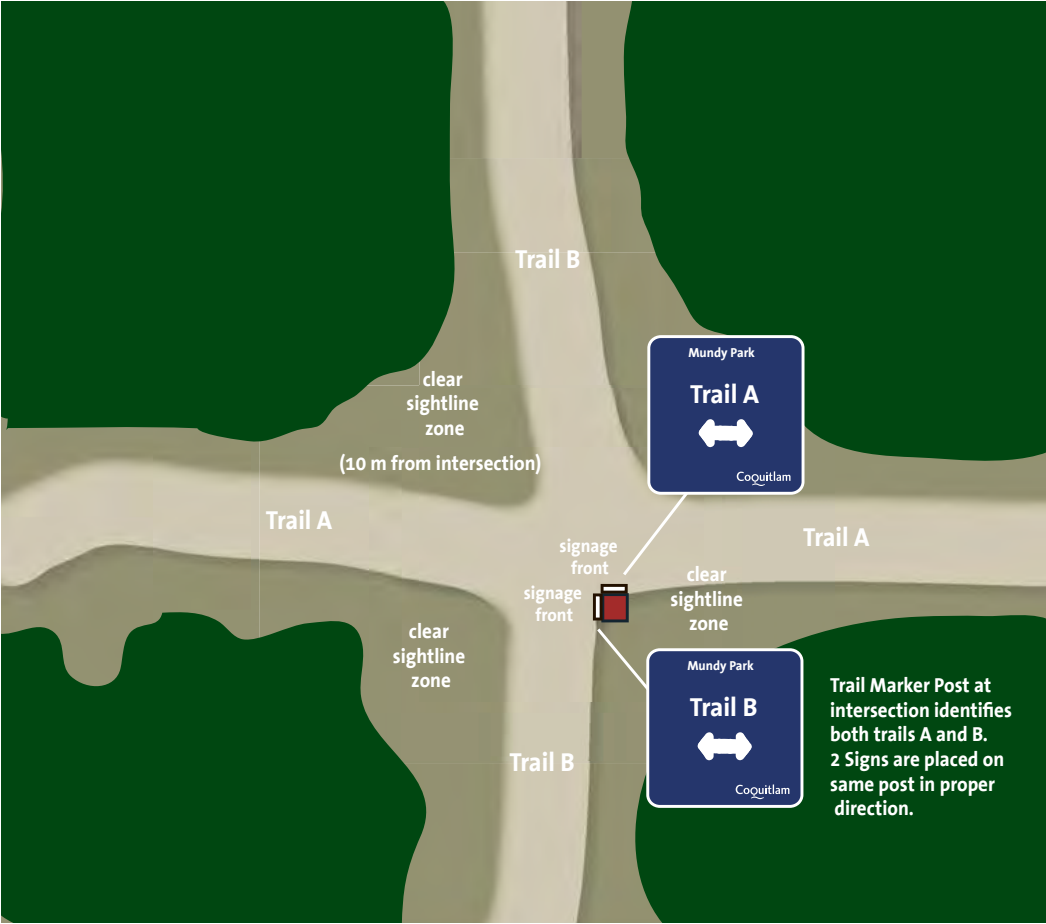


Diagram 3 – Alternate 3 – Way

**Diagram 3.
Alternate Trail Placement Markers at 3-Way Intersection.**

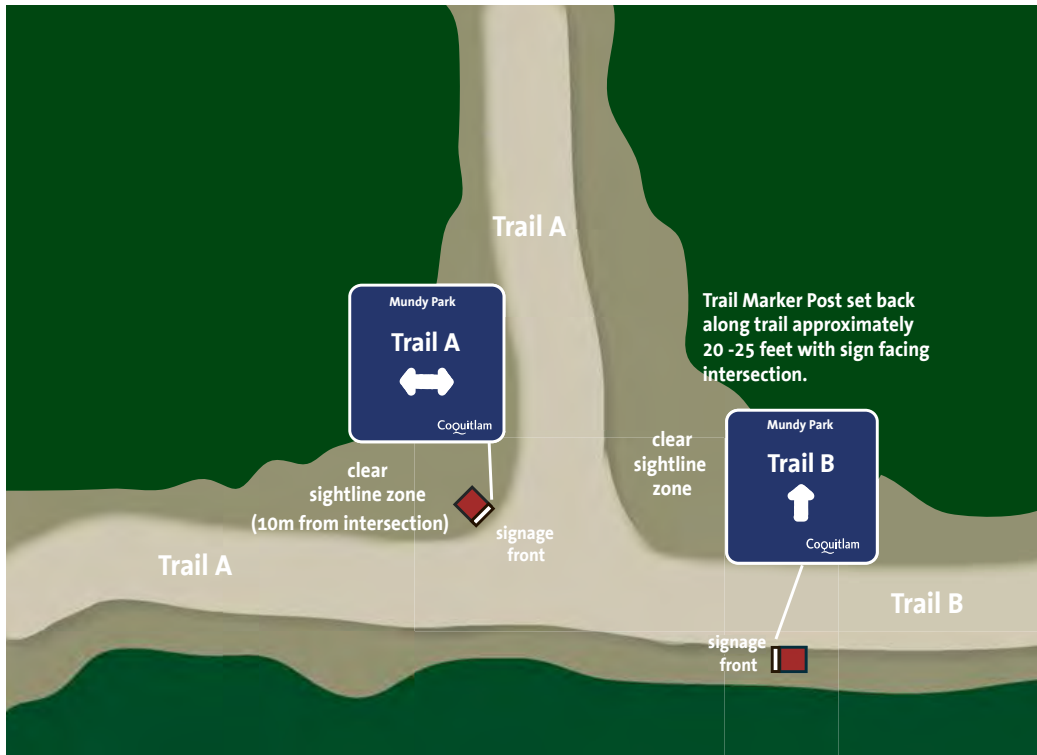
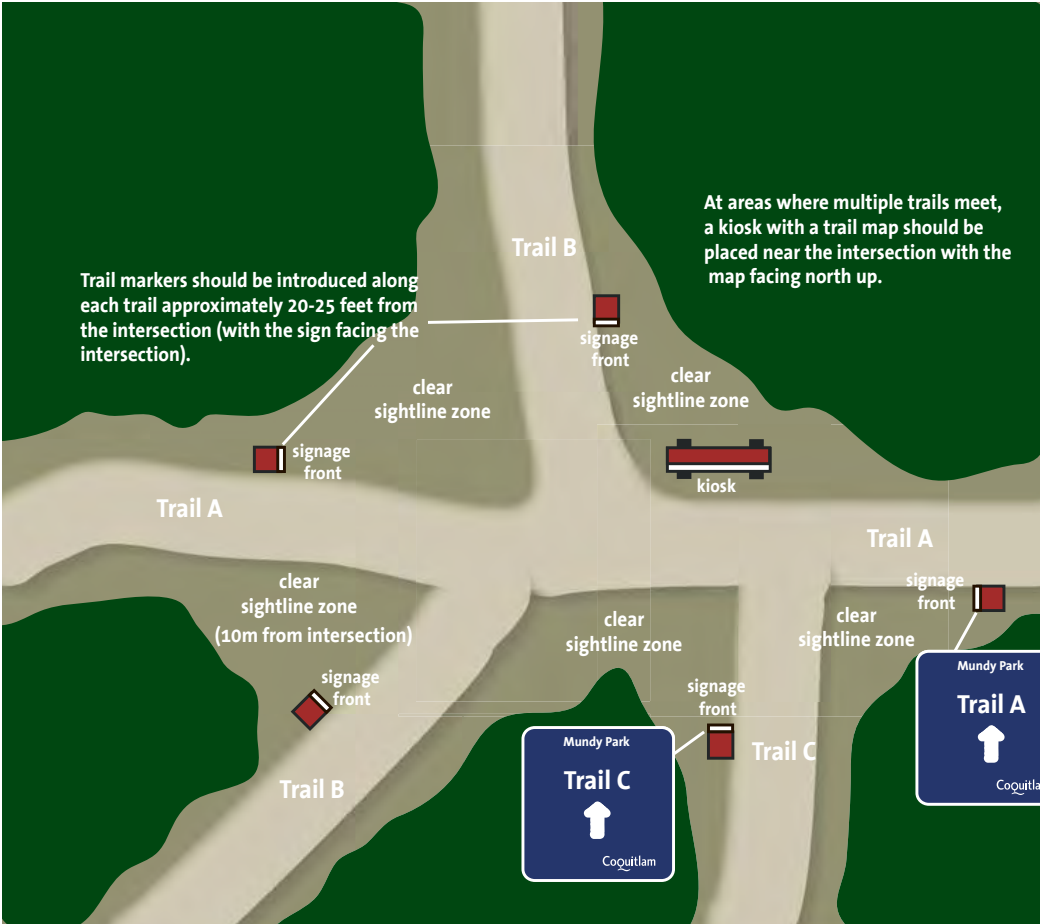


Diagram 4 - Multi-trail Intersection

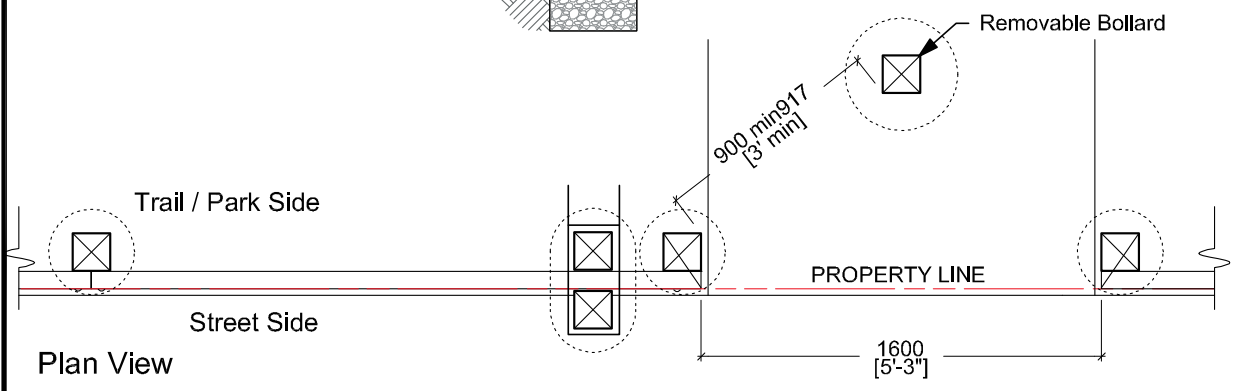
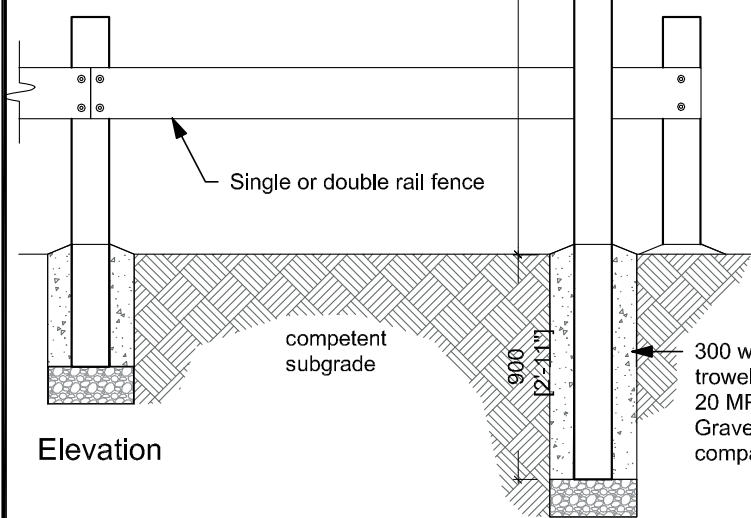
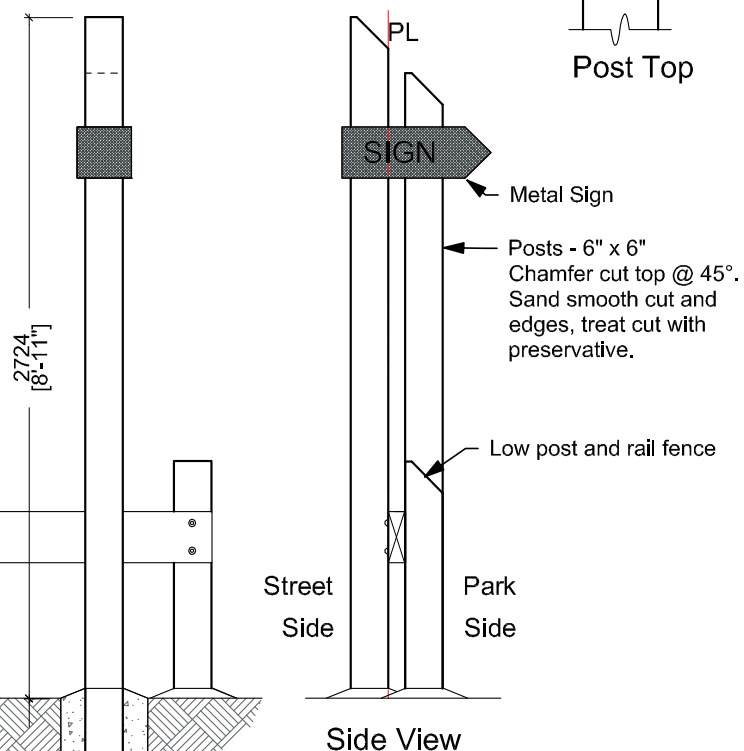
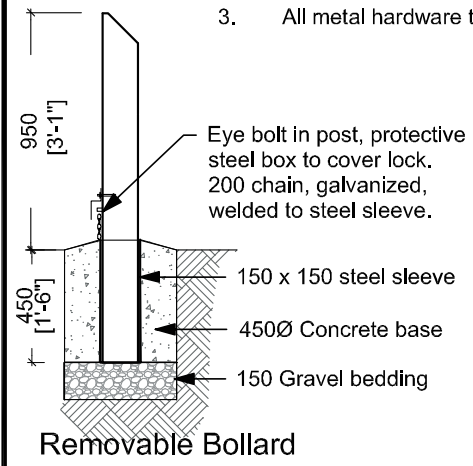
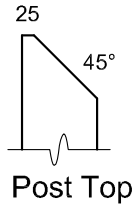
Diagram 4.
Trail Placement Markers at Multi-Trail Intersection.



D9- Park Sign – Trail Entry

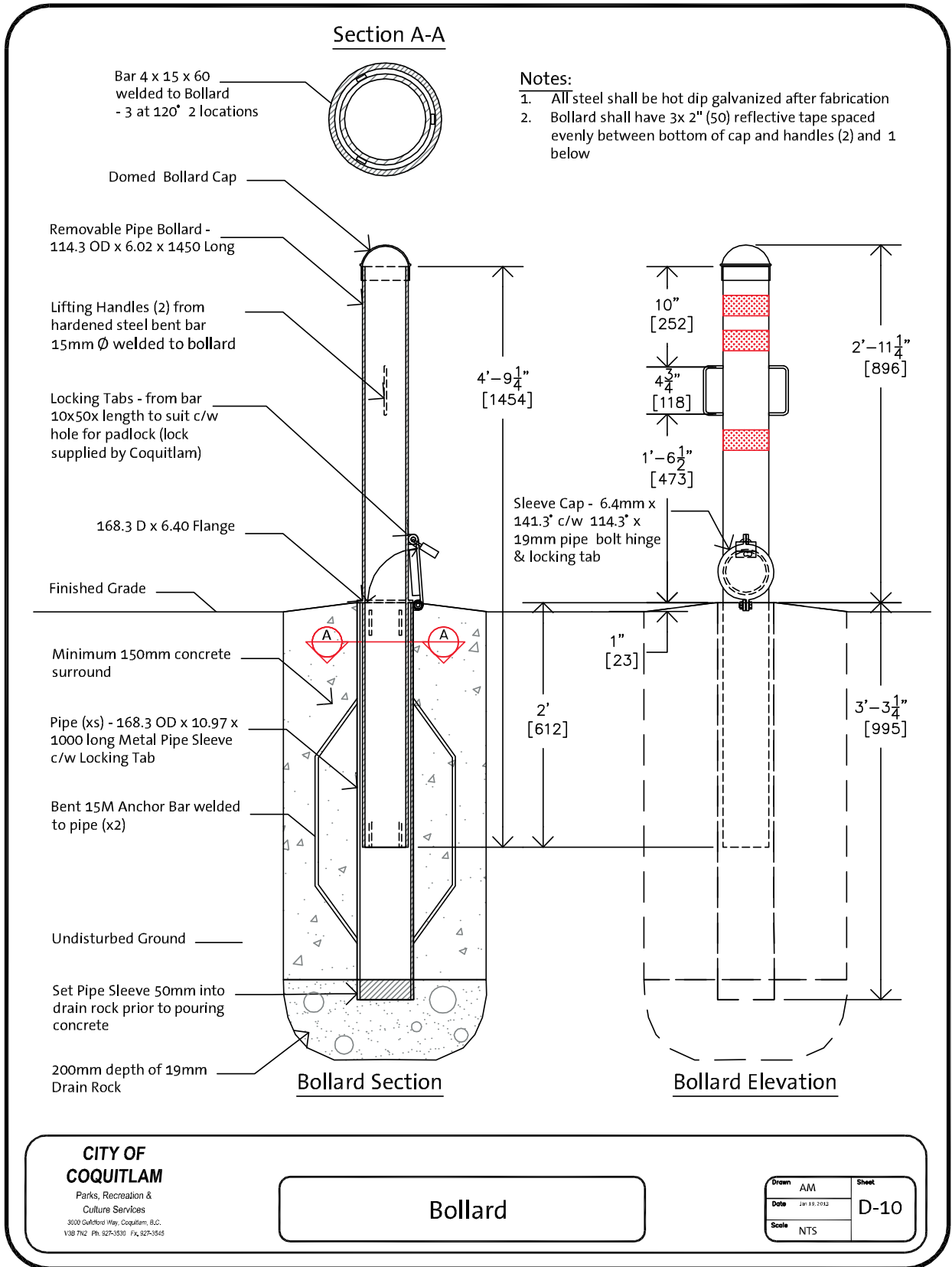
Notes:

1. All wood to be #1 grade pressure treated S4S hem/fir or better.
2. All cuts to be treated with 2 coats wood preservative to match PT colour.
3. All metal hardware to be hot dip galvanized unless noted otherwise.



CITY OF COQUITLAM Parks, Recreation & Culture Services <small>3000 Guildford Way, Coquitlam, B.C. V3B 7N2 Ph: 527-3530 Fx: 927-3545</small>	Park Sign - Trail Entry		Drawn AM Date JAN 15, 2013 Scale NTS	Sheet D-9
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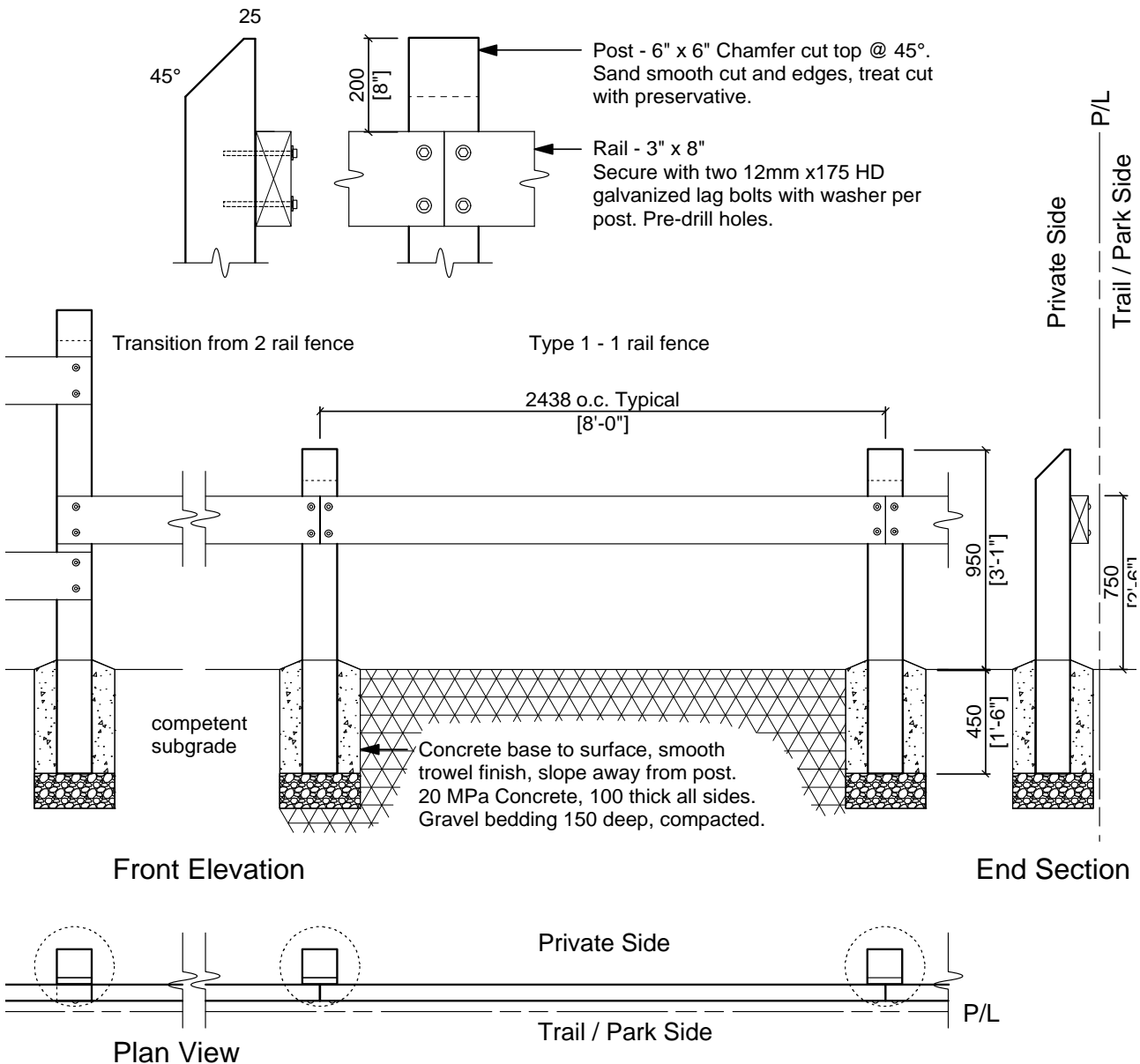
D10 – Bollard



D11 – Single Rail Fence

Notes:

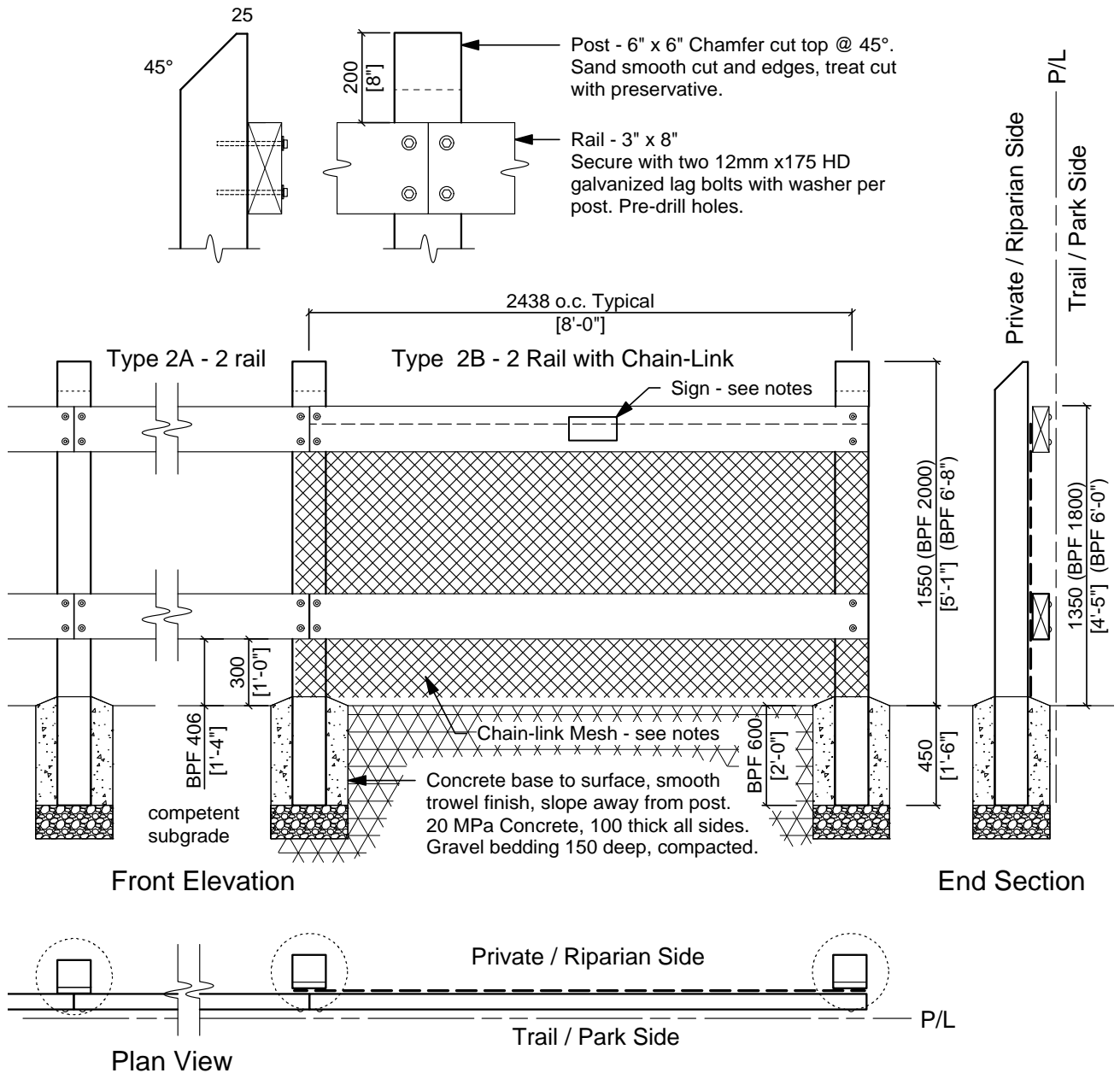
1. All wood to be #1 grade pressure treated S4S hem/fir or better.
2. All cuts to be treated with 2 coats wood preservative to match PT colour.
3. All metal hardware to be hot dip galvanized unless noted otherwise.



D12 – Double Rail Fence

Notes:

1. All wood to be #1 grade pressure treated S4S hem/fir or better.
2. All cuts to be treated with 2 coats wood preservative to match PT colour.
3. All metal hardware to be hot dip galvanized unless noted otherwise.
4. Sign at riparian area only: Sensitive Fish and Wildlife Habitat.
5. Fencing - Black vinyl coated chain link mesh. Attach to timber posts and rails with heavy duty staples. Gap to ground varies with terrain - 150mm maximum to 50mm minimum. Do not extend mesh above top rail.
6. **BPF** - Bear & Predator resistant Fence dimensions.

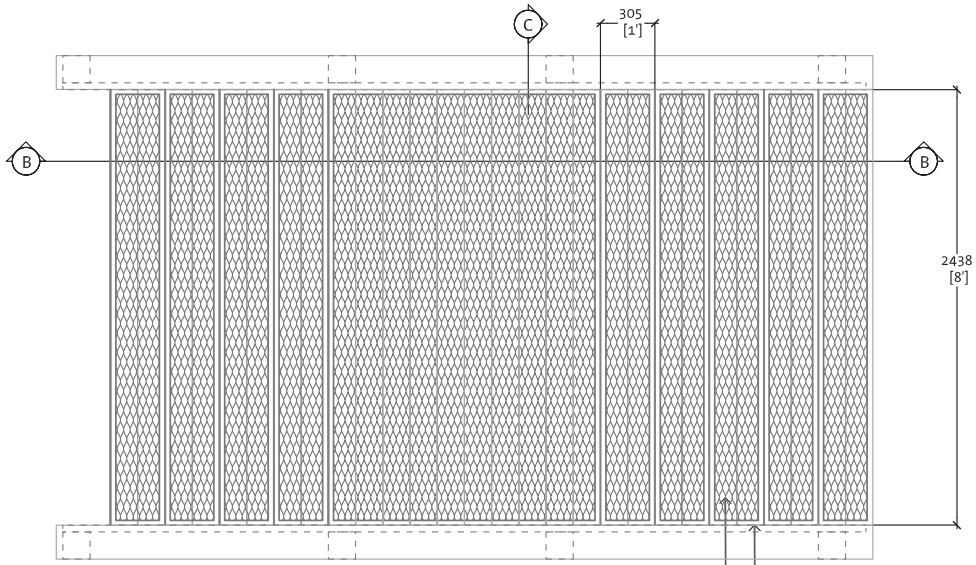


CITY OF COQUITLAM
Parks, Recreation & Culture Services

Fence Type 2 - Double Rail Trail Fence
STD. DETAIL NO. **2012 - 7 - b - 2**

Scale: not to scale
Drawn: AJM
Date: October 31, 2014

D13 – Timber Stairs

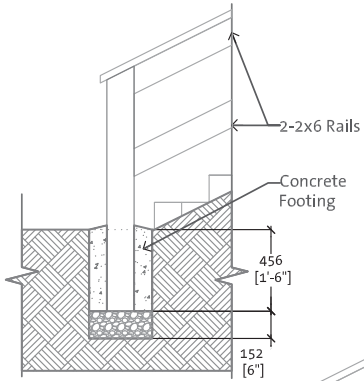


A Stair Plan

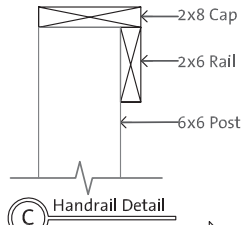
Notes:

1. All steel shall be hot dip galvanized
2. All Wood Pressure Treated #2 or Better Douglas Fir
3. Treat all cut edges with 2 coats of wood preservative

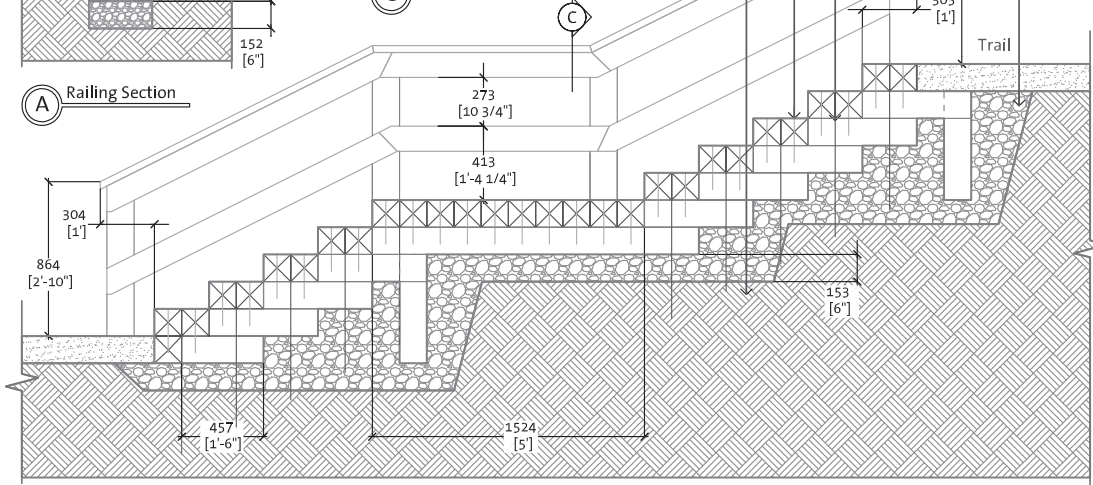
6x6 Treads (2 per Tread)
 $\frac{3}{4}$ " Diamond Expanded Aluminum Mesh fastened w/ Aluminum or Galvanized Fencing Staples



A Railing Section



C Handrail Detail



B Stair Section

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Parks, Recreation & Culture Services
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Timber Stairs

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Date	Mar 24, 2015	D-13	
Scale	NTS		

D14 – Metal Post Chain Link Fence

NOTES:

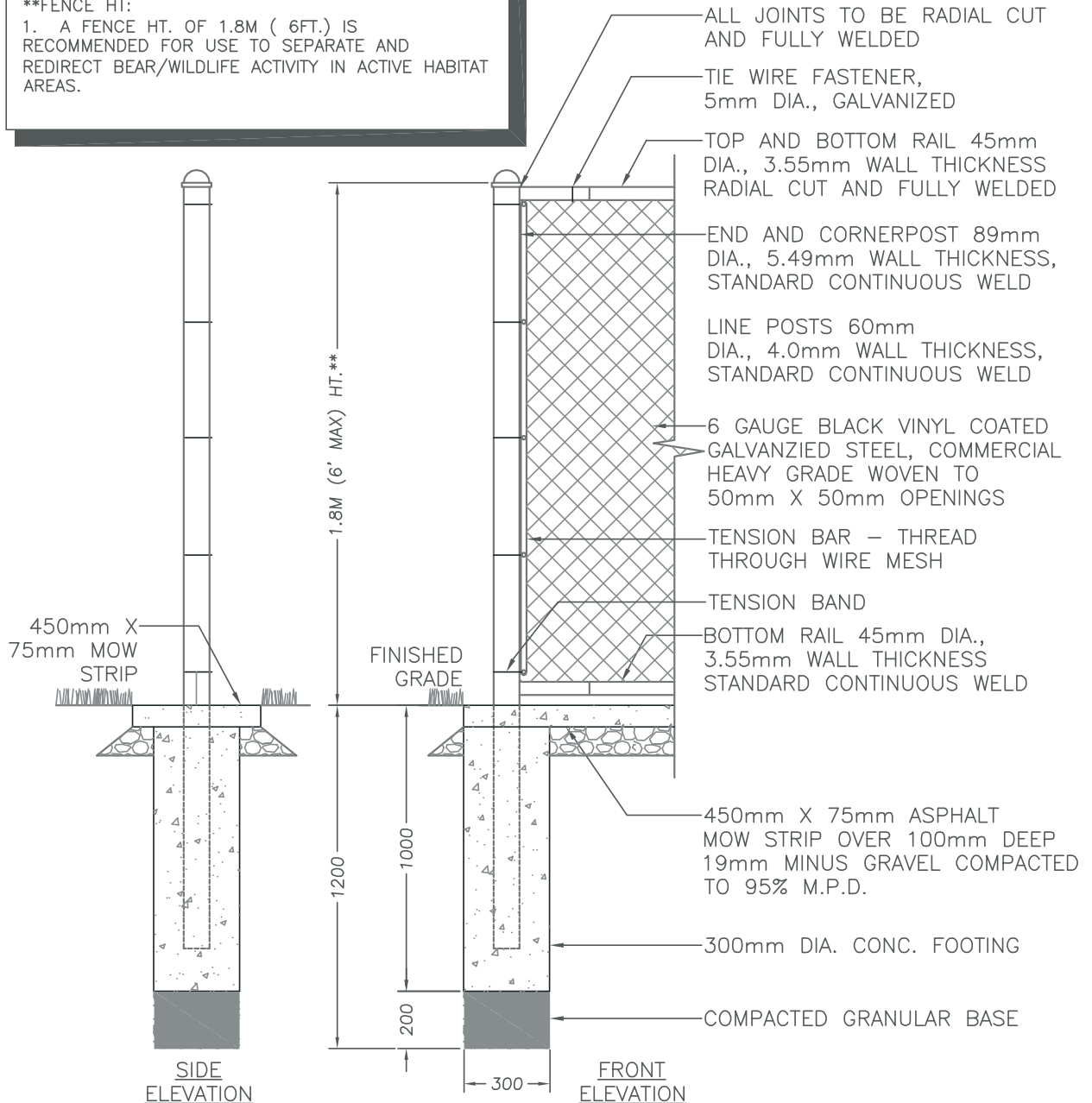
1. ALL PIPING TO BE SCHEDULE 40 PIPE

GATES:

1. FRAMES 41mm O.D. STD. GALV. PIPE WELDED TO MATCH FENCE. C/W HARDWARE I.E. HOLDBACKS, LOCKING DEVICE, HINGES TO PERMIT 180° OPENING.

****FENCE HT:**

1. A FENCE HT. OF 1.8M (6FT.) IS RECOMMENDED FOR USE TO SEPARATE AND REDIRECT BEAR/WILDLIFE ACTIVITY IN ACTIVE HABITAT AREAS.



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Parks, Recreation & Culture Services

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V3B 7N2 Ph. 927-3530 Fx. 927-3545

Metal Post Chain Link Fence

detail

Drawn	JC	Sheet	
Date	2/10/10 4/02/13REV	D-14	
Scale	1:20		

Trail Maintenance

Trail Maintenance and Operations

The trail maintenance practices are consistent with maintenance standards applied to park and street landscape. Trail maintenance programs shall address waste removal, signs, trail markers, clearances and sight lines, surfacing repairs, structural damage, drainage, sweeping, and clearing. Specific maintenance practices will vary depending upon location, level of use and surrounding area.

Maintenance of All Trails

- ❖ Establish a reporting procedure that enables the public to notify the City of maintenance needs.
- ❖ Respond promptly to maintenance requests.
- ❖ Provide convenient detours if maintenance operations limit access.
- ❖ Review the vegetation adjacent to trails. Remove hazardous trees and limbs.
- ❖ Pick up garbage a minimum of every two weeks.
- ❖ Regularly check no-slip metal mesh on bridges to ensure there is no tripping hazard.

Maintenance Levels

Maintenance Level 1: (Trail connector maintenance may be less if the adjacent park is a more natural passive type of park) Routine inspections of trail surface, drainage and other facilities are conducted. The frequency will be relative to the level of use and maintenance requirements of each trail. Maintenance work will include debris removal, mowing and/or pruning of adjacent clear zone during growing season to maintain grass and vegetation within maximum height of 150 mm; pavement remarking, snow removal and resurfacing when required.

Maintenance Level 2: Routine inspections of trail surface, drainage, other facilities and for environmental damage are conducted. Grade and resurface trail surface as required. Mow or brush adjacent clear zone during growing season to maintain vegetation within clear zone to a maximum height of 300 mm.

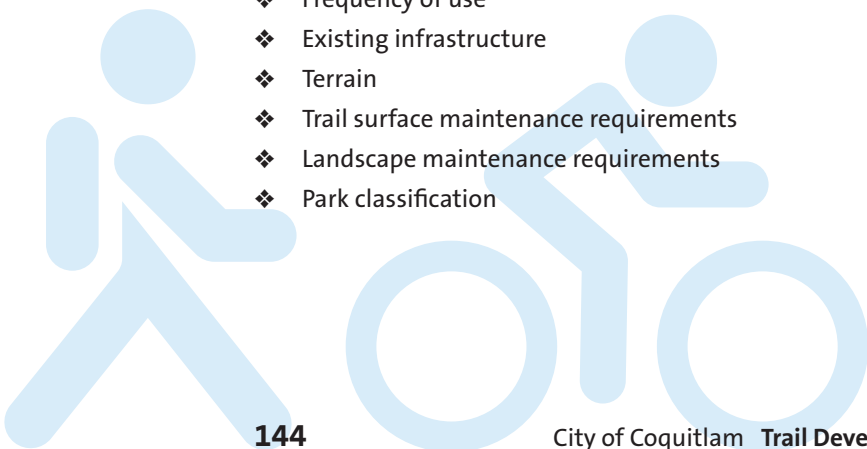
Maintenance Level 3: Routine inspections of trail surface drainage, other facilities and for environmental damage are conducted. Brush along trail as needed during growing season to maintain vegetation within clear zone to a maximum height of 450 mm. Use rocks and natural materials to prevent water from eroding trail surface as required.

Trail Sign Maintenance: Establish a sign inventory that lists the type, location and date of installation. Establish a sign maintenance log that updates the following information on a monthly basis: type of sign requiring replacement, location of sign and reason for replacement (e.g. vandalism, deterioration), cost of replacement and timing of replacement.

Trail Inspections

Frequency of trail review and inspection are based upon the following criteria:

- ❖ Frequency of use
- ❖ Existing infrastructure
- ❖ Terrain
- ❖ Trail surface maintenance requirements
- ❖ Landscape maintenance requirements
- ❖ Park classification



Criteria and associated numerical ratings are compiled to determine an inspection priority for each trail. Trail inspection frequency is related to the trail rating as follows:

- ❖ Low Rating – Quarterly Inspections
- ❖ Medium Rating – Bi-Monthly Inspections
- ❖ High Rating – Monthly Inspections

Calls for Service

Response to calls for service and inspection through public or staff notification of trail hazards, infrastructure damage, vandalism and graffiti will be addressed beyond the typical schedule. Priority for response will be according to degree of hazard to public health and safety.

Vandalism

Unresisted vandalism will encourage more nuisance activity. Trail vandalism and graffiti will be dealt with quickly to discourage repeat occurrences within 48 hours if possible.

Invasive Species

Control and removal of invasive plants such as blackberry near public trails helps to reduce further spread of invasive plants but also reduces the food source and attractant for wildlife (e.g. bears) near trails, trail users and residents. Installation of replacement plant material with non-invasive, non-bear attracting native or combination of native and ornamental shrubs and groundcovers will be appropriate especially along trail edges and within sightline clearance zones. Continued monitoring and inspection for reestablishment of invasive plants is an on-going part of trail maintenance practices.

Safety

Safety in the trail system is of utmost importance. Other sections of this document have also addressed other kinds of safety. The following are some specific guidelines related to design, construction and maintenance practices that support safety.

Crossings: At grade trail crossings of arterial roads should only be located at intersections with traffic signals. For all street and railway crossings, refer to the city's Strategic Transportation Plan (STP) guidelines.

Speed: Controlling excessive speed on multi-use pathways can be difficult. Pathway design, public education and signage should help to control speed.

Hazards: Depending on the proximity and steepness of the grade changes, pathways next to steep slopes should have vegetation and/or a railing between the trail surface and the slope. In extreme cases, warning signs should be used. Utility poles close to or within the trail surface should well marked, or painted with warning symbols. If necessary, planting areas and/or railings should be added.

Rules of Use: Adopt "rules of the road" for use of the trail system and post these at major Trailheads. Rules may include keep right, "wheels yield to heels", cyclists sound warning. Where necessary identify the suitable/permitted use on each type of trail.

Recreational Off-Road Cycling Facilities Maintenance Standards

(Excerpt: City of Coquitlam Off-Road Cycling Strategy Report, 2007)

On-going maintenance and maintenance standards are outlined in memorandums of co-management agreements. Municipal staff and/or municipal consultants can work closely with stewardship clubs or groups to ensure facilities are maintained to standards so trails continue to be safe and function as they were designed.

Maintenance Standards

Trail inspections and trail maintenance are integral to managing and minimizing the city's ongoing exposure to risk associated with off-road cycling trails. The development of maintenance standards is essential for different trail difficulty levels. Routine trail maintenance will extend the life expectancy of trails, providing a high quality trail product and continued safety for trail users.

Regular trail maintenance will preserve the trail route, associated trail structures and TTF's. Routine trail maintenance will keep repairs minimal and prevent major damage.

Routine Trail Inspections

Trail inspections shall focus primarily on user safety followed by environmental considerations. A typical trail inspection will include documenting the condition of trail surfaces, structures (bridges, boardwalks), TTF's / obstacles, surrounding vegetation, safety sightlines, drainage features, signage as well as documenting the occurrence of any maintenance triggers. Trail inspections shall be documented using a standard trail maintenance and condition inspection form to ensure consistency.

Maintenance Triggers

Maintenance triggers identified from the trail inspection may include:

- ❖ trail braiding or widening resulting from erosion, or users avoiding obstacles such as water or rocks.
- ❖ Technical trail feature or bridge structure deterioration.
- ❖ Scouring of trail materials from soil erosion by natural causes such as water or mechanical causes from tires.
- ❖ Trail slumping, where trails on side slopes slump or slide down the hillside. Typically occurs when trails are not properly cut into the hillside and/or the outside edge of the trail is not adequately supported.
- ❖ Exposed root system of trees and shrubs or erosion from users short cutting corners or switchbacks.

Community Partnerships

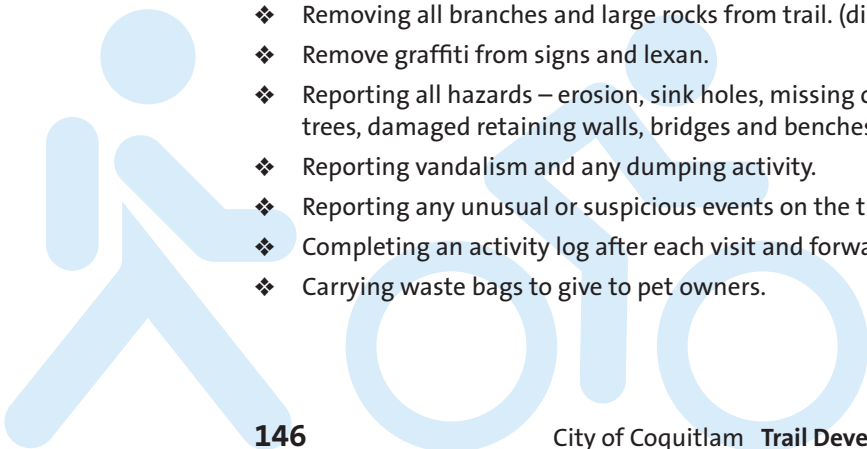
Adopt-a-Trail Programs

The City's current Adopt-a-Trail program helps involve the public, encourages stewardship, ownership and provides added maintenance and monitoring.

The duties of the volunteer are to visit the trail at least once a week or as often as possible from April to October and once a month from November to March.

Duties for volunteers may include:

- ❖ Keeping the trail clean from litter and garbage.
- ❖ Leaving garbage at the nearest parks trash can. If there is nothing available, call City coordinator for trash pickup.
- ❖ Removing all branches and large rocks from trail. (dispose of in bush)
- ❖ Remove graffiti from signs and lexan.
- ❖ Reporting all hazards – erosion, sink holes, missing or damaged signs, dangerous/fallen trees, damaged retaining walls, bridges and benches.
- ❖ Reporting vandalism and any dumping activity.
- ❖ Reporting any unusual or suspicious events on the trail.
- ❖ Completing an activity log after each visit and forward to the City coordinator.
- ❖ Carrying waste bags to give to pet owners.





City of Coquitlam

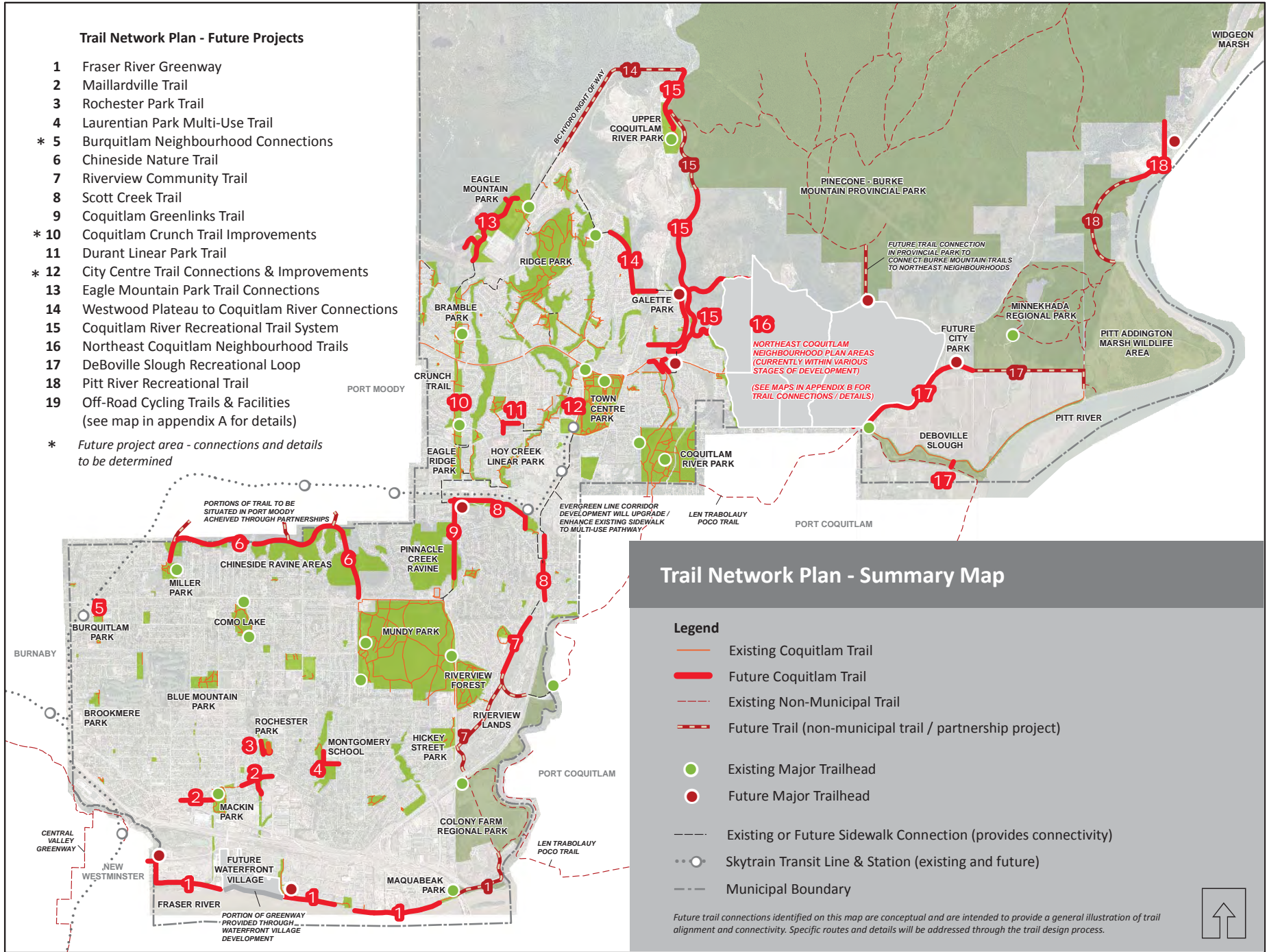
Appendix I – Trail Network Plan



Coquitlam

Trail Network Plan - Future Projects

- 1 Fraser River Greenway
 - 2 Maillardville Trail
 - 3 Rochester Park Trail
 - 4 Laurentian Park Multi-Use Trail
 - * 5 Burquitlam Neighbourhood Connections
 - 6 Chineside Nature Trail
 - 7 Riverview Community Trail
 - 8 Scott Creek Trail
 - 9 Coquitlam Greenlinks Trail
 - * 10 Coquitlam Crunch Trail Improvements
 - * 11 Durant Linear Park Trail
 - * 12 City Centre Trail Connections & Improvements
 - 13 Eagle Mountain Park Trail Connections
 - 14 Westwood Plateau to Coquitlam River Connections
 - 15 Coquitlam River Recreational Trail System
 - 16 Northeast Coquitlam Neighbourhood Trails
 - 17 DeBoville Slough Recreational Loop
 - 18 Pitt River Recreational Trail
 - 19 Off-Road Cycling Trails & Facilities
(see map in appendix A for details)
- * Future project area - connections and details to be determined



Trail Network Plan - Summary Map

- Legend**
- Existing Coquitlam Trail
 - Future Coquitlam Trail
 - Existing Non-Municipal Trail
 - Future Trail (non-municipal trail / partnership project)
 - Existing Major Trailhead
 - Future Major Trailhead
 - Existing or Future Sidewalk Connection (provides connectivity)
 - Skytrain Transit Line & Station (existing and future)
 - Municipal Boundary

Future trail connections identified on this map are conceptual and are intended to provide a general illustration of trail alignment and connectivity. Specific routes and details will be addressed through the trail design process.





City of Coquitlam

Appendix II – Off-Road Cycling Strategy



Coquitlam

Off-Road Cycling Trail /Mountain Biking Facilities

(Excerpt: City of Coquitlam Off-Road Cycling Strategy, 2007)

Trail Difficulty Rating – Single Track Trails

Off-road cycling Trail difficulty ratings address the need to describe and present the degree of challenge a trail poses to of road cyclists. Although trail difficulty ratings associated primarily with mountain bike trails generally correlate with certain trail types, difficulty ratings are not necessarily dependant or based on trail type classifications.

Single-track trails frequented by off-road cyclists are by nature quite different from traditional hiking, commuting, and walking trails. Hiking trails generally strive to reach certain points of interest via the route of least resistance, i.e.: low grade and wide, or steep with less regard for terrain features. These single-track trails are constructed to maximize the aesthetic appeal of the terrain. Soil, logs, lumber, and rock are sometimes used to enhance and create new landforms. Trails meander through a landscape from one feature to the next; the most successful and popular trails “flow” through the landscape in this endeavour. Trails and man-made technical trail features (TTFs) have evolved with these technological advances to encompass astoundingly creative and sometimes extremely difficult trails and structures. For this single-track off-road cycling trails are not grouped by function but rather by degree of challenge or difficulty.

The trail difficulty rating is determined according to the green circle, blue square, black diamond, double black diamond system, used predominantly in the ski industry and adopted by the International Mountain Bike Association (IMBA), and is defined in the following section. Trail widths and standards generally match the difficulty of the trail, i.e.: a narrower steeper trail will be rated as more difficult, while a wider gentler trail is much easier. This is reflected in the rating system.

A difficulty rating has been applied to all trails within the City of Coquitlam where riding a bike can reasonably be expected to occur. Off-road cycling trail difficulty ratings associated with trails should not be considered as trail use designations for a particular type of use. Hikers, trail runners, walkers and other users may use trails of any difficulty rating.

Off-Road Cycling Trail – Difficulty Rating Matrix

Mountain Bike Trail Difficulty Ratings	GREEN CIRCLE	BLUE SQUARE	BLACK DIAMOND
APPROPRIATE USER	Beginners and Recreational Riders. Mountain Bikes recommended. Safety equipment required (including helmets).	Intermediate Riders. Mountain Bikes required. Increased challenges and difficulty. Full safety equipment required.	Advanced/Expert Riders. Difficult and technical challenges. Full safety equipment required. High level of fitness required.
TRAIL DESCRIPTION	Gentle slopes and easily avoidable obstacles such as rocks, roots and pot-holes.	Challenging riding with steep slopes and/or obstacles, narrower trails with reduced traction. Requires riding experience.	Mixture of long steep climbs and descents, loose trail surfaces, numerous difficult obstacles to avoid or jump over, drop-offs and sharp corners. Some sections easier to walk than ride.
FEATURES	Embedded trail obstacles up to 10 cm. high.	Embedded trail obstacles up to 20 cm. high	Embedded trail obstacles may exceed 20 cm.
MINIMUM WIDTH	1 metre	50cm	30cm

Mountain Bike Trail Difficulty Ratings	GREEN CIRCLE	BLUE SQUARE	BLACK DIAMOND
TRAIL SURFACE	Primarily soil and small loose rock, occasional compacted aggregates.	Rough natural terrain and increased rock and root debris. TTF's (see below)	Rugged natural terrain. See TTF's below.
AVERAGE GRADE	8%	10%	15%
MAXIMUM GRADE	15%, except rock faces at 25%	Climbing – 25%, Descending – 35%, Rock Surface - 45%	Climbing – 35%
MINIMUM CURVE RADIUS	2.4 m.	1.8 m.	Sharp Corners
EXPOSED NATURAL OBSTACLES (MAX. HEIGHT)	10 cm. max. height. Occasionally higher height for highly visible, easily avoidable obstacles.	20 cm. max. height	Various heights, some exceeding 20cm.
BRIDGES (MIN. WIDTH)	Min. 1.0 m.	Minimum width of 50 cm. Flat decking is minimum one-half the height above surface.	Various widths. Minimum 30 cm. Flat width of decking is one-quarter the height above surface. Elevated bridges less than 3 m. high above surface.
TECHNICAL TRAIL FEATURES (TTF'S)	Small roots and logs to cross, embedded rocks to avoid.	TTF width to height ratio of 1:2. Small bridges (flat, wide, low and rollable from section to section).	
Small rollable drops. Small teeter-totters, less than 60 cm. high. Small jumps. Medium sized logs.	TTF width to height ratio of 1:4. Elevated bridges and teeter-tooters with maximum deck height. Connected Bridges. Larger Jumps. Steep descents with sharp transitions.		
ROCK FACE OR RAMP DESCENTS (MAXIMUM ANGLE)	Rock face descents not to exceed 25% grade.	45%	Not to exceed 120%
DROPS (MAX HEIGHT)	None	Drops up to 30 cm., with exit cleared of all obstacles	Drops greater than 30cm. Some mandatory air.
JUMPS (MAX HEIGHT)	None	45 cm. No jumps with consequences for lack of speed. Table top jumps max. 40 cm. high.	Table tops, no maximum height. No gap jumps.

ORC - Trail Design Guidelines and Construction

The construction guidelines and standards focus primarily on single-track, non-surfaced trails defined as Nature Trails classification in the MTP.

The International Mountain Bicycling Association (IMBA) guide *Trail Solutions: IMBA's Guide to Building Sweet Singletrack* (2004) provides an invaluable guide to trail construction techniques and drainage solutions for trail builders. Based on frequency and intensity of use, mountain biking constitutes the highest potential for trail damage. Since mountain biking can be expected on almost any trail and since IMBA's guidelines are also applicable to hiking trails, they should be consulted as a comprehensive set of guidelines for trail construction activities. The Provincial Mountain Bike Policy refers to the IMBA guidelines and the *Whistler Trail Standards* when planning, constructing and rehabilitating and maintaining trails.

Natural areas found within the City of Coquitlam are primarily rain forest type ecosystems with a maritime influenced climate. Water erosion is the largest detrimental force for trails throughout the Lower mainland. Trails located on steep slopes with shallow bedrock are especially prone to turning into drainages when not properly constructed. Care must be taken, especially on steeper trails, to provide for proper water management. All trail design and construction must be completed in consultation with an experienced trail builder familiar with local conditions.

Off-Road Cycling Trail Construction Guidelines

1. Minimize environmental impacts, avoid, where possible:
 - environmentally sensitive features including wetlands and critical habitat areas.
 - historic, cultural or archeological sites
 - constructing trails parallel to watercourses within riparian areas. Trails should approach streams and creeks at right angles to minimize potential for erosion.
2. Resist erosion, avoid, where possible:
 - highly erodable, steep slopes prone to erosion
 - plan trail grades to avoid fall lines and flat spots; utilize grade reversals
 - ensure trails have "out-slope" to direct water off the surface
3. Blend with existing environment:
 - plan contours and "flow" appropriately for trail type and expected use.
 - utilize existing natural features where possible including view points, rock outcropping, forest features.
 - plan trails networks to consider all users; easier trails located in proximity to trails heads relative to more difficult trails.

Design and Construction of Technical Trail Facilities (TTFs)

Design Principles

Construction of technical trail features should adhere to the following design principles:

- ❖ **Visibility**
By making the most difficult section of the TTF visible from the entry, riders can make an informed decision if they wish to proceed or not. By placing a narrow or difficult section at the beginning of a longer TTF, where it is low to the ground, less skilled riders will dismount early where the consequences of a fall are the choice of the rider.
- ❖ **Strength and Stability**
The Structure must be capable of supporting a centered vertical load of 200 kg and a horizontal load of an 80 kg adult leaning against the constructed feature with less than 5 cm of displacement.
- ❖ **Height and Width**
Maximum height and width are dependant on the trail, and the feature's difficulty rating. Difficult features should be located on difficult trails, and vice versa. Bridges on green, blue

and black trails that exceed height standards as noted in Mountain Bike Trail Difficulty Ratings should be equipped with a railing for safety. Please note that handlebars can be as wide as 75 cm. Minimum distance between railings should be at least 1m.

Materials and Construction Standards

The following construction standards must be adhered to when constructing TTF's:

- ❖ When possible, native materials should be used. Sills should be cedar or treated wood. Douglas fir is the preferred material for weight-bearing members (stringers, purloins, beams), split cedar rails are the preferred material for surfacing. Dimensional lumber may be used, it should be noted that standard SPF (spruce pine, fir) materials are not very durable when exposed to weather. Treated lumber is preferable.
- ❖ Weight bearing members should be notched and cross-braced where they join.
- ❖ Whole logs should be peeled to slow the onset of rot, and increase joint strength and fastener penetration.
- ❖ Acceptable fasteners are, in order of structural integrity:
 1. Galvanized Carriage Bolts and Nuts (with galvanized washers)
 2. Galvanized Lag Screws and Washers
 3. Galvanized Ardox Spikes and Nails (spiral spikes for their superior holding strength)
- ❖ Lag Screws and Nails should be of adequate length to allow for 2/3 penetration of the member being screwed or nailed into.

Bridge Rung Spacing and Surfacing

- ❖ Deck rungs shall be spaced 1-2 cm to allow for water and mud drainage.
- ❖ Rungs shall not overhang stringers by more than 5 cm.
- ❖ Rungs shall be securely fastened with a minimum of 2 or more (preferably 4, if practical) large bolts, lag screws, or ardox nails (see above).
- ❖ It is recommended that wood surfaces, particularly those with a grade, have an anti-slip surface. Expanded diamond lath or granular roofing materials are both acceptable. Chicken wire is not acceptable, as it wears quickly. The anti-slip surface should be fastened every 15 cm. square.

4. Fall Zone Standards

Fall Zones are areas adjacent to TTF's (Trail Technical Features), sharp corners, and steep descents which provide a reduced risk area for riders to deviate into. Fall zones cannot eliminate the potential for injury; however, a common-sense approach to establishing safer trails through the minimization of trailside hazards will be used to mitigate the potential for injuries. Fall zones will be cleared of the following materials:

- ❖ Large shrubs with hard woody branches
- ❖ Stumps cut flush with ground or pulled out
- ❖ Tree branches trimmed to branch collar
- ❖ Non removable hazards covered with mulch or decayed wood
- ❖ Rocks with pointed or sharp edges should be dulled, or removed

Not all ground covering vegetation should be removed from the fall zone. Moss, grasses, herbaceous and small shrub cover should be left to avoid soil erosion and to deter riders from enlarging the trail into the fall zone.

Fall zones shall be considered especially important on blue and black trails, where less experienced riders may be honing their riding skills and the opportunity of falling is increased.

❖ **Fall Zone Locations and Size**

Fall zones will be established in the following locations:

- Outside of steep corners -1.5m
- Bottom of steep descents – 1.5m
- Adjacent to TTF's - <30 cm – 1m; >30cm – 1.5m

Off Road Cycling Facility Locations

The off-road cycling strategy has identified a variety of off road cycling amenities and facilities to enhance the off road cycling trail experiences and provide the diverse cycling community with some alternative cycling experiences. To realize the coordinated network of bike facilities and bike parks across the City of Coquitlam, facility location determination was guided by the application of facility development principals and the evaluation of potential facility locations using the facility suitability matrix (Figure 1). With the application of the following development principals, all new City of Coquitlam off road cycling facilities will be

1. **Accessible** → Proposed facilities will serve all Coquitlam community areas, off road cycling groups and user abilities. Facilities will be centrally located and make provisions for spectator accommodation.
2. **Flexible** → Proposed facilities will be designed to be flexible, allowing them to be changed and / or expanded over time as rider preferences and user groups change and evolve.
3. **Integrated** → Facilities are to be centrally located and connected by trails and Strategic Transportation Plan bike routes. Trails and bike routes will allow users to bike facilities and move between facilities using their bikes.
4. **Safe** → Facilities will include features for a wide range of abilities and age groups. All stunts will be designed to be safe and fun to ride. Facilities to be located in visible high traffic areas. Facilities to provide access for emergency vehicles.
5. **Sustainable** → Where practical and feasible, facilities will be located in parks with existing facilities including parking, washrooms and water. The development of new facilities will consider surrounding environmental resources including soils, topography, drainage, vegetation, and wildlife. Appropriate mitigation measures to be developed to reduce impacts.

After individual facility locations were considered using the facility development principals, potential facility locations were evaluated using a suitability matrix (Figure 1). The suitability matrix identifies potential locations within the City of Coquitlam identified for Mountain Bike use against the criteria used in determining suitable locations. Suitable location criteria included the consideration of facility proximity to schools, transportation hubs, and existing recreation features, existing trails or other recreational amenities, opportunities for the development of new trailheads and future facility expansion, as well as potential environmental concerns. The matrix has been grouped according to the Type (Adventure Park, Gravity Park and Intensive Trail Network Park and Staging Facility) and the location of proposed off road cycling facility.

Based upon the application of the facility development principals, the facility suitability matrix (Figure 1), and public consultation in June 2006 the City of Coquitlam Off Road Cycling Strategy has compiled a list of potential bike facilities locations. Potential facility locations have been grouped according to their geographic trail network area.

Eagle Mountain Trail Network Area

The trail network area centers on Eagle Mountain Park, Bramble Park and Ridge Park. Other parks that contribute trails to this network area include Noons Creek Park and North Hoy Creek Ravine. Because of the steep grades associated with the network area, most of the trails have been classified as blue trails. Potential mountain bike amenities or facility types that have been identified at these locations include an Adventure Park, a Gravity Park, and two potential Trail Staging Facilities. Eagle Mountain is a popular mountain bike trail network area; however, it is outside the City limits and was not considered in this strategy.

Potential Facility Locations

Bramble Park Potential Gravity Park and Adventure Park	
Positive Attributes	Potential Drawbacks
<ul style="list-style-type: none"> > Existing trail linkages with Eagle Mountain network > High visibility > Close proximity to existing, similar recreation features > Potential “green corridor” connectivity north – south via corridor 	<ul style="list-style-type: none"> > Isolated from population base to south and west > Fragmented by residential roads

Eagle Mountain Park Potential Trail Staging facility and Adventure Park	
Positive Attributes	Potential Drawbacks
<ul style="list-style-type: none"> > Provides a linkage between City park biking areas and the popular mountain bike trail areas > Under used park area with plenty of parking > Physically isolated from residential areas 	<ul style="list-style-type: none"> > Isolated from population base to south and west > Encourages use of illegal and unmanaged trail network.

Coquitlam River Burke Mountain Trail Network Area

The trail network area centers on Coquitlam River Park and the Town Center Park. Future parks that will contribute trails to this network area include Freemont Park and Harper Park. Because of the low angle terrain associated with the network area, most of the trails have been classified as green trails. Potential mountain bike amenities or facility types that have been identified within the network area include a Trail Network Park, two Adventure Parks, and two potential Trail Staging Facilities for access into existing mountain bike trails associated with Burke Mountain Park. Pipeline Park, located within Town Center Park, is a well used MTB/BMX jump park that complements this network area.

Potential Facility Locations

Coquitlam River Park: Potential Trail Network Park and Adventure Park	
Positive Attributes	Potential Drawbacks
<ul style="list-style-type: none"> > Connectivity with Trans-Canada trail and Burke Mountain area. > Close proximity to POCO Bike Park > Existing MTB use, opportunity to improve network and existing trails. > New Bridge over Coquitlam river improves connectivity over the Coquitlam River 	<ul style="list-style-type: none"> > Potential Drawbacks > conflict with existing trail users (dog walkers) > at edge of municipal boundary adjacent to POCO,

Town Center Park: Existing Dirt Jump / BMX Park and Skate / Urban Park Potential Trail Staging Area	
Positive Attributes	Potential Drawbacks
<ul style="list-style-type: none"> > High visibility, well used established facility > Close proximity to existing, similar recreation facilities (skate park, other trails) > Trans Canada Trail runs through Park. > Excellent staging area for regional trails like the POCO Trail and Burke/Eagle Mountain Trail Areas > Available parking > Close to transit station, train station 	<ul style="list-style-type: none"> > Geographically isolated from the Blue Mountain Area. > Geographically isolated from traditional mountain bike areas.

Leigh Park Potential Adventure Park	
Positive Attributes	Potential Drawbacks
<ul style="list-style-type: none"> > New neighborhood area, may be able to develop new trails through the development process > No existing use > Good staging area for rides in the northeast sector and Burke Mountain 	<ul style="list-style-type: none"> > On margin of City boundary > POCO has developed similar facility in close proximity (Coquitlam River)

Mundy / Riverview / Pinnacle Creek Network

The trail network area centers on a hydro corridor separating Mundy and Riverview Parks. Pinnacle Creek Park, and its associated hydro corridor, have been identified as potential areas to support new trail and MTB facility development. Mundy Park provides excellent green trails and Riverview Park is an existing mountain bike trail area with mostly blue trails. Potential mountain bike amenities or facilities types that have been identified within the network area include a Trail Network Park, three Adventure Parks, and a Gravity Park location.

Potential Facility Locations:

Riverview Park: Potential Trail Network Park and Adventure Park	
Positive Attributes	Potential Drawbacks
<ul style="list-style-type: none"> > Underutilized park > Used by local bikers, including organized high school groups > Easy access from Blue Mountain area > Network exists; development will improve existing trails, including stream crossings > Concentrates MTB use away from Mundy Park > Development of park will manage recreation within old growth stand 	<ul style="list-style-type: none"> > Potential conflict with existing users (dog walkers, pedestrians) > Location is remote and isolated from Burke and Eagle MTB areas to the north > One of the only remaining mature/old growth stands

Pinnacle Creek Park: Potential Gravity Park and Adventure Park	
Positive Attributes	Potential Drawbacks
<ul style="list-style-type: none"> > Good use of low value land (under hydro right-of-way > Potential “green corridor” connectivity north-south via hydro right-of-way > No identified current use > Staging facilities – schools at north and south ends of corridor. 	<ul style="list-style-type: none"> > Limited space > No connectivity to existing trail networks

Maillardville / Makin Park: Adventure Park	
Positive Attributes	Potential Drawbacks
<ul style="list-style-type: none"> > Geographically isolated from other proposed bike facility park areas > Potential connectivity with Fraser River greenway trail system > >its within Coquitlam’s plan to increase outdoor recreational amenities for the Maillardville area 	<ul style="list-style-type: none"> > Limited space > Loughheed Hwy and TransCanada Hwy are obstacles to connection with the Fraser River Greenway trail system

Figure 1: Off Road Cycling Facility Suitability

Adventure Park Name	Style	Location						Proximity to Existing Recreation Features			Staging / Spectator / Expansion Potential			Environmental		
		Secondary Schools	Elementary Schools	High Pedestrian Traffic Area	Major Transit Hub	Other Recreation Facilities	Proximity of Existing Trails	Staging Facilities	Potential for Spectator Accommodation/ Parental Supervision	Expansion Potential	Sensitive Areas (ESAs)	History of Disturbance				
		<1 km	<2 km	<1 km	<2 km		Mountain Bike	Multi Use	Existing	Potential						
Riverview Park – AP	Adventure Park	1	2	1	7	No	Within 2 km	Mundy Park, Frisbee Golf	Riverview Trails, (rough network)	Mundy Park Trails	Yes	Yes	Yes	Good	Riparian zones; old growth forest	Within cleared hydro ROW
Town Centre – AP	Adventure Park	2	4	3	6	Yes	Within 500 m	Skate park, dirt jumps, baseball, tennis, basketball, track	No	Town Centre Park Trails	Yes	Limited	Yes	Limited	No	Urban, disturbed area
Coquitlam River Park – AP	Adventure Park	1	2	0	3	No	Within 2 km	Trans Canada Trail	Coquitlam River (rough network); within 2.5 km of Burke Mountain network	Coquitlam River (maintained network)	Limited	Yes	Yes	Good	Riparian zones; potential rare plant communities	Minimal, fragmented forest, prolific trail braiding
Pinnacle Creek Ravine – AP	Adventure Park	1	4	3	7	No	Within 2 km	School Fields	No	No	School Parking Lots	Yes	Yes	Good	TBD	Within cleared hydro ROW
Bramble Park – AP	Adventure Park	1	4	1	5	Yes	Within 5 km	Baseball, Tennis, Basketball	Less than 2 km from Eagle Mountain network	Yes – Bramble Park trails	Yes	Yes	Yes	Good	No	Within cleared hydro ROW
Pinnacle Creek Ravine – G	Gravity Park	1	4	3	7	No	Within 2 km	School fields	No	No	School Parking Lots	Yes	Yes	Good	TBD	Within cleared hydro ROW
Bramble Park – G	Gravity Park	1	4	1	4	Yes	Within 5 km	Baseball, Tennis, Basketball	Less than 2 km from Eagle Mountain network	Yes – Bramble Park trails	Yes	Yes	Yes	Good	No	Within cleared hydro ROW
Coquitlam River Park – ITN	Intensive Trail Network	1	2	0	3	No	Within 2 km	Trans Canada Trail	Coquitlam River (rough network); within 2.5 km of Burke Mountain network	Coquitlam River (maintained network)	Limited	Yes	N/A	Good	Riparian zones; potential rare plant communities	Minimal, fragmented forest, prolific trail braiding
Riverview Park – ITN	Intensive Trail Network	0	2	2	6	No	Within 2 km	Mundy Park, Frisbee Golf	Riverview Trails, (rough network)	Mundy Park Trails	Yes	Yes	N/A	Good	Riparian zones; old growth forest	Minimal, fragmented forest, prolific trail braiding

Sign Guidelines (Draft)


Signs are a critical component of a coordinated trail strategies. Signs ensure users have the information they need to make informed choices about their recreation experience, based on degree of challenge, trail condition, length etc.. Adequate and informative signage also constitutes a necessary component of a comprehensive risk management program. By clearly explaining risk associated with a trail and adequately marking those risks on the trail, managers minimize their exposure to potential liability.

Provide signage at network entrances, trail heads and at strategic points along junctions or as a warning of an approaching difficult section or feature. .

Trailhead Sign Specifications

The following trailhead sign specifications have been adopted by the province of BC, the Resort Municipality of Whistler, and the District of Squamish for multi-use trails. These signs are provided as an example the signage that as been adopted by the Sea to Sky Corridor. It is anticipated that the Province will be adopting these standards with the new Provincial Trail Strategy.

Sign specifications example

Component	Description	
Size:	140mm x 370mm	
Background colour	Pantone	
Mounting	wood post measuring 150mm wide*150mm pre-treated or western red cedar top of post 1.5m above ground	
Fonts Type /Size	Trail Name Difficulty Explanation Difficulty Rating Disclaimer Condition Statement	
Icons		
Logos	Provincial Logo Club/sponsorship Logo	
Font Colour		

En Route Sign

En Route Signs indicate to users the direction of the desired trail at junctions. These signs indicate the technical difficulty rating, the name of the trail and direction of travel. En route signs may also be placed along the trail where the route is difficult to follow.

En-route sign specifications

Component	Description	
Size:	90 mm x 240 mm	
Background colour	White - reflective	
Mounting	wood post measuring 100mm x 100mm pre-treated or western red cedar top of post 1.0m above ground	
Fonts Type /Size	Trail Name Difficulty Rating Disclaimer	
Icons	Difficulty Rating Symbol Green Circle Blue Square Black/DB Diamond Directional Arrows Users	
Font Colour	Black	

Mountain Bike Trail Hazard Conflict and Impact Reduction Strategies

Excerpts:

Authorizing Recreational Mountain Bike Trails on Provincial Crown Land – Appendix 1
(<http://www.sitesandtrailsbc.ca/documents/mountain-bike-policy.pdf>)

Mountain Bike Trail Hazard, Conflict and Impact Reduction Strategies

This appendix describes strategies for mitigating safety, user conflicts, and impact issues that are potentially associated with mountain bike trail development and use. Depending on the specifics of individual trail situations, these may be adopted as provisions in trail agreements, proposed as voluntary measures, or put into action by MTSA as part of general implementation of the MTSA recreation sites and trails program.

Reducing Safety Hazards

When processing applications and implementing agreements for mountain bike trail construction, rehabilitation and maintenance, MTSA Recreation Officers will consider the following factors that can influence public safety risks:

- ❖ Whether the trail system involves TTFs, either man-made or natural;
- ❖ Whether the trails, facilities and features are developed and managed according to guidelines/standards;
- ❖ Steepness of trails;
- ❖ Speed at which trails are/will be ridden;
- ❖ Adequacy of visibility/sight lines along trails;
- ❖ Volume of use that the trails receive;
- ❖ Degree to which trails are accessible/proximate to settled areas, and therefore receive a
- ❖ high volume of use by a wide cross-section of users;
- ❖ User profile (e.g., are riders experienced/skilled, novice, knowledgeable about the area, a combination thereof);
- ❖ Potential for encounters with other trail users (e.g., hikers, equestrians, dirt bikers, etc.);
- ❖ Potential for trail instability/deterioration and environmental damage (e.g., as a result of erosion);
- ❖ Whether or not the local mountain bike club has demonstrated capacity/interest in developing and managing safe trail systems; and
- ❖ Other factors that may influence hazard/safety levels, as identified by the Recreation Officer (staff or consultant)

Strategies for managing public safety include:

- ❖ **Authorization of Appropriate Trails** – Authorize trail works only if public safety (and other) issues can be sufficiently addressed.
- ❖ **Management Agreements** – Enter into long-term trail agreements with qualified organizations to ensure appropriate trail development and upkeep.
- ❖ **Enforce Guidelines and Standards** – Require conformance with the IMBA Guidelines and *Whistler Trail Standards*.
- ❖ **Remove Hazards** – Close/dismantle all or a portion of a trail or TTF.
- ❖ **Mitigate a Hazard** – Modify a trail or TTF to remedy a hazard situation.
- ❖ **Rider Education** – Promote rider education/awareness of risk levels and safe riding techniques (e.g., through communication materials, safety workshops, etc.).
- ❖ **Rider Skills** – Enhance rider skill levels/abilities (e.g., through skills camps).
- ❖ **Trail Builder Education** – Educate trail building volunteers on skills and techniques for building safe and sustainable trails.

Reducing Recreational and Resource Use Conflicts

Options for addressing conflict between mountain bike riders and other recreational users, and conflict with other resource users, are listed below in the general order of preference for implementation. (Note: For more information, see the IMBA document *The Minimum Tool Rule: A Hierarchy of Options for Managing Trail User Conflicts*, available at www.imba.com/resources/bike_management/hierarchy.html).

- ❖ **Post Signs** – For example, advising caution; reminders of trail ethics/conduct; urging cyclists to stay on routes, slow down, limit party size, consider other users; identifying any local trail ‘rules’ that may be in effect; etc.
- ❖ **Self-Monitoring** – Encourage cyclists to patrol their own ranks in a positive way.
- ❖ **Education** – Work with local clubs, bike shops and others to educate riders about low impact and responsible trail use, riding etiquette (codes of conduct/ethics), and consideration for other users. Develop posters, brochures, and logos or trademarks as a reminder/symbol of considerate cycling. Educate local mountain bike groups about proper procedures/standards for designing and building sustainable trails.
- ❖ **Relationship Building** – Encourage positive interaction among different trail users (e.g., joint trail maintenance projects, forming trail advisory committees).
- ❖ **Training** – Develop and implement training programs on low impact cycling to be presented by clubs, organizations, bike shops, etc.
- ❖ **Trail Design** – On new trails or trails that can be modified, include design features that restrict speed and enhance sight distance, and build wide or pull-out sections to facilitate safe passing (see Whistler and IMBA design standards/guidelines).
- ❖ **Barriers to Speed Control** – Subject to safety considerations, leave or install barriers in the trail to control speed (e.g., rocks, roots, bumps, tight curves, down trees, speed barriers, water bars).
- ❖ **Requested Walking Zone** – Signs that request or require cyclists to walk their bikes in certain areas where speed, recklessness or congestion are potential problems.
- ❖ **One-way Only** – Designate direction of travel on trails with heavy use, to avoid the potential for collisions.
- ❖ **Post Speed Limits** – Set maximum allowable or recommended speeds for cyclists. Encourage voluntary compliance or involve local cyclists in positive enforcement. Encourage speeds that allow a cyclist to stop in less than half the distance they can see.
- ❖ **Patrols** – Use trained volunteer groups to patrol trails and talk with cyclists to dispense advice, and monitor compliance with trail rules and codes of conduct.
- ❖ **Restrict Cyclists by Time** – Allow for mountain bike use only at certain times of the day, or on certain days when other use may be at lower levels (e.g., odd/even days or weekend/week day schedules).
- ❖ **Separate Sections** – Construct separate routes for mountain bike use where there is the greatest congestion (e.g., at trailheads).
- ❖ **Construct Separate Routes** – Construct separate routes for mountain bike use where there is strong user support and where other solutions are not feasible.
- ❖ **Zoning** – Close certain areas to mountain biking (or other recreation uses) and encourage that use on other areas. This method depends on having other areas available and useable.
- ❖ **Closures** – Close areas to mountain bike riding (by FRPA order) and enforce the closure.
- ❖ This option should be a last resort after other efforts have proven ineffective.
- ❖ MTSA may also facilitate local *management planning processes* that bring together the affected interests to cooperatively identify solutions for addressing user conflicts (and possibly other)
- ❖ issues. The planning processes may identify any of the above, or other, solutions for addressing conflict and impact issues.

- ❖ To help prevent potential mountain bike trail conflicts with other resource users (notably forest managers), MTSA will, as appropriate, designate mountain bike trails under FRPA (section 56), establish objectives for these trails, and/or establish trails as ‘resource features’ under the FRPA
- ❖ Government Actions Regulation.

Reducing Impacts On Environmental and Resource Values

To address potential issues of mountain bike trail development and use impacts on environmental and other resource values, MTSA will apply the following strategies, as appropriate, to individual situations and as resources permit:

- ❖ **Proactive Planning** – Ensure that areas appropriate and suitable for mountain bike trail development/use are identified through management planning processes that consider sensitive environmental and other resource values (e.g., wetlands, unstable soils, valuable habitats, cultural/heritage values).
- ❖ **Environmental Design** – As part of the trail authorization process, encourage mountain bike clubs to work with land managers in a process to identify/map sensitive values, and design and construct trails accordingly. Apply the IMBA guidelines and Whistler standards for environmental design (e.g., stream crossings, drainage, habitat considerations, appropriate trail widths, environmentally sensitive construction materials and best practices).
- ❖ **Monitoring and Impact Mitigation** – Monitor environmental impacts from trail development and use (e.g., erosion, water quality, vegetation disturbance, wildlife disturbance), and mitigate problems as they arise. Mitigation may involve the need to permanently or temporarily close or relocate a trail or trail segment (e.g., during wet periods, during wildlife breeding periods), rehabilitate an area, re-design a trail segment or feature, educate riders, etc.
- ❖ **Rider Education** – Work with local mountain bike clubs and other interests to educate riders on ways to minimize environmental impacts (e.g., stay on the trail, ‘riding’ vs. ‘sliding’), and prevent the spread of noxious weeds. Use signage as appropriate.



City of Coquitlam

Appendix III – Trail Surfacing Alternatives



Coquitlam

Alternative Pavement Surfaces for Multi-use Trails

Introduction

This brief report provides a summary of the various alternative pavement surfaces to asphalt for urban multi-use trails. The selection of suitable materials for consideration was established based on past experience; interviews with engineers, contractors and maintenance personnel; and review of the current literature.

The contacts ranged throughout Canada and the United States, with a focus on B.C. and the Northwestern U.S. The literature review included various publications on the topic from local, provincial, and federal levels of government, as well as professional publications and Internet listings.



Old Time Asphalt Installation

Analysis

The analysis of the pavement surfaces considered the following criteria: Uses, Permeability, Capital Costs, Operating Costs, Life Expectancy, and Advantages/Disadvantages.

The *Uses* category analyzes uses within the context of the existing and future Urban Multi-use trail system in Coquitlam. The uses include pedestrian walking and jogging, bicycle, stroller, wheelchair, rollerblade, skateboard, and vehicular service uses, including fire truck access. It is assumed that the Urban Multi-use Trail will be located in natural and developed settings and that horses will not be permitted on these trails.

The *Permeability* of the various surfaces is rated on a relative scale (i.e., impermeable, slightly permeable and permeable). An impermeable surface would be expected to shed all of the water that falls on it (e.g. asphalt). A slightly permeable surface would be expected to absorb light rain, but to shed water during a heavy or persistent rainfall (e.g. some gravel). A permeable surface would be expected to absorb all or most of the rain that falls on its surface (e.g. popcorn asphalt). Although a pathway surface may be permeable, the underlying material in the area largely influences infiltration into the ground. For example, popcorn asphalt on a heavy soil will not provide an advantage in terms of permeability unless there is either an extensive underground drainage system or the path is raised above the surrounding material with a permeable base course. The literature indicates that permeable pavement can be expected to lose its permeability over time as the voids get filled with debris, so maintenance is required to clean out the voids, and replacement may be required over the long term.

Alternative Pavement Surfaces for Multi-use Trails

The relationship between impervious surfaces and stormwater management should be noted. Impervious surfaces can cause erosion in receiving waters (e.g., creeks) if the impervious surface water is channeled in solid drainpipes directly into the creek. This can also transfer toxic chemicals from the impervious surface to the creeks. If the impervious surface is not hydraulically connected by pipes and is instead allowed to infiltrate into the surrounding ground, the negative effects of impervious areas are greatly reduced. Therefore, an asphalt path in a park may be impervious, however it is not contributing to environmental degradation unless the runoff is piped from the surface directly into the creek.

Capital Costs are provided for the alternative surfaces. They include supply, delivery and installation of the pathways. These costs are only ballpark estimates, but they provide a basis for comparison.

Operating Costs are provided in relative terms (e.g. high, medium and low) over the life span of the pathway. A list of typical maintenance activities is included with the material summaries. Pathway maintenance can vary depending on location, visibility, use and public perception. For example, an asphalt path in a remote wooded location might only be blown clean once per month while an asphalt path near City Hall might require weekly cleaning. For comparison purposes, it is assumed the pathways would be in similar locations. The long-term maintenance can also vary. For example, an asphalt path through the woods could be subject to heaving from tree roots while an asphalt path through a manicured park with mowed grass would have a lower resurfacing requirement.

Life Expectancy provides a relative indication of the time the surface is expected to last with proper maintenance. Materials, installation, level and type of use, and maintenance practices will all influence pathway life expectancy.

Advantages and Disadvantages are provided for each of the trail surfaces.

Alternative Pavement Surfaces for Multi-use Trails

Summary Table

Following is a table, which summarizes the alternative pavement surfaces:

Surface	Uses	Permeability	Capital Cost	Operating Cost	Life Expectancy	Advantages	Disadvantages
Asphalt	All	Impermeable	\$20.00-\$25.00/m ²	Low	Long	Inexpensive, durable, familiar	Petroleum-based, impermeable
Open-Graded Mix Asphalt	All - except Rollerblading and Skateboarding are more difficult	Permeable to Slight to Impermeable (varies with design and installation techniques)	\$25.00-\$35.00/m ²	Moderate	Unknown, but is anticipated to be slightly less than Asphalt	Permeable, durable	Cost, possible reduced usage, petroleum-based
Polymer Surface Coatings	All	Impermeable	\$25.00-\$35.00/m ² *	Low	Unknown, but is likely less than Asphalt	Environmentally friendly	Not widely installed in BC, should be used in test plots first
Powder Stabilizers	All - except Rollerblading and Skateboarding	Slight to Impermeable	\$20.00-\$28.00/m ² **	Moderate	Unknown, but is likely less than Asphalt	Environmentally friendly	Not widely installed in BC, reduced usage
Concrete	All	Impermeable	\$30.00-\$35.00/m ²	Low	Very Long	Durable, familiar	Cost, leachate concerns, impermeable
Crushed Aggregate	All - except Rollerblading and Skateboarding	Slight to Impermeable	\$12.00-\$15.00/m ²	Moderate	Relatively short	Inexpensive, familiar	Reduced usage
Crushed Concrete	All - except Rollerblading and Skateboarding	Slight to Impermeable	\$11.00-\$14.00/m ²	Moderate	Relatively short	Inexpensive, familiar, locally available	Reduced usage
Pavers	All - except Rollerblading and Skateboarding are more difficult	Impermeable	\$35.00-\$45.00/m ²	Moderate	Less than Asphalt	Attractive, durable, familiar	Cost, impermeable
Permeable Pavers	All - except Rollerblading and Skateboarding are more difficult	Permeable	\$42.00-\$50.00/m ²	Moderate to High	Less than Asphalt	Attractive, environmentally friendly	Cost, maintenance

* Landscape Architecture Magazine indicated that in the U.S., Polymer Surface Coatings can cost as much or more than asphalt. Since the product is relatively new to BC, initial pricing might be higher.

** Landscape Architecture Magazine indicated that in the U.S., Powder Stabilizers can cost a third the price of asphalt. Since the product is relatively new to BC, initial pricing might be higher.

Summary of Trail Surfacing Types

Following is a summary of the different surfaces:

Asphalt - Asphalt is widely used as a surface for multi-use paths in B.C. It is readily available and can be installed by most contractors. There are environmental concerns relating to air quality during installation, petroleum-based by-products leaching off, and impermeability. The Asphalt Institute in the United States refutes the claims regarding poor air quality and leaching. Asphalt can be visually intrusive, especially in natural areas.



Urban Multi-use Trail in Coquitlam

Maintenance required for asphalt walks includes sweeping or blowing at regular intervals (ranging generally from once per month to twice per year), repairing cracks approximately once per year, minor resurfacing approximately once every 10 years, and installing a new lift approximately every 20 years.

Open-Graded Mix Asphalt – For the purposes of this report, open-graded asphalt mixes include “Popcorn” asphalt and “Superpave”. These asphalt mixes are typically used on roads due to their rut-resistance and noise reduction capabilities. They are not typically used on pathways. Open-graded mixes can be designed to be permeable (e.g. by compacting the subgrade to less than the recommended density), but sub-surface water needs to be accommodated. Sub-surface drainage such as perforated piping is often required. Open-graded asphalt contains the same elements as conventional asphalt with a higher percentage of coarse aggregate in the mix offering a high void ratio and a coarse texture. These types of surfacing would not be recommended in wet areas or in areas where springs are anticipated.



Open-graded Asphalt

Maintenance required for open-graded asphalt walks includes sweeping and/or vacuuming at regular intervals, periodic weed eradication, repairing cracks once per year, minor resurfacing approximately once every 10 years, and installing a new lift approximately every 20 years.

Alternative Pavement Surfaces for Multi-use Trails

Soil Binder – Soil binders or aggregate binders are typically derived from plant by-products and provide alternatives to traditional pathway surfaces like asphalt or concrete. Soil binders do not contain petrochemicals or other harmful components that can leach from other types of surfaces. There are two general types of soil binders. For the purposes of this report, soil binders have been broken down into two general categories;



Polymer Coated Walk



Skateboarder on Powder Stabilizer Surface

- *polymer surface coatings* (e.g. “Polypavement” or “Road Oyl”) and
- *powder stabilizers* such as “Stabilizer Solutions”.

These types of products have had limited use in BC, but offer a compelling alternative to asphalt.

Polymer Surface Coatings – “Polypavement”, “Road Oyl” and other similar products were originally developed to control dust on landfill roads. They are liquid applications that are used to bind native sand and soil to form a resin pavement. The U.S. Army Core of Engineers uses Polypavement for constructing landing strips and roads in foreign countries such as Bosnia. These materials utilize the native materials and as a result, they blend well with surrounding areas. Polymer surface coatings are not permeable.



Polymer Coated Pathway in California



Polymer Coated Walk

Alternative Pavement Surfaces for Multi-use Trails

Powder Stabilizers – “Stabilizer Solutions” and similar products are non-toxic powder applications that combine with imported aggregates to make a paving surface that looks and feels like a well-compacted gravel path. The Everett Country Club in Everett Washington installed “Stabilizer Solutions” in 1993 and is extremely pleased with the result. The first application of the product was used in a steep, turning section of cart path that has heavy foot traffic and service vehicles. Besides blowing debris off the surface, they have not had to perform any maintenance on that section of path. They have since used the product in several other areas of the golf course including a sloped parking lot and some wet areas where it has also held up well. The surface is reported to be acceptable for wheel chairs, bicycles, canes, high heels, and vehicles. It is slightly permeable. During a light rain, water is absorbed into the pathway, but in a heavy rain, water runs off the surface. The City of North Vancouver has recently used a powder stabilizer on some of their new construction. Baseball fields are often surfaced with powder stabilizers.



Powder Stabilizer Pathway in California



Powder Stabilizer Path in Everett Washington

Maintenance required for soil binder pathways includes blowing off debris at regular intervals. The Everett Country Club does not need to blow off the powder stabilizer walks as frequently as asphalt walks since the users have a higher tolerance for leaf litter on a gravel surface than on an asphalt surface. Other maintenance activities include periodic weed eradication and repair of cracks or holes once per year. Repair of damaged areas is much easier than with asphalt or concrete walks. It is not clear if or when the soil binder pathways would require surfacing, but these paths would likely require a new lift approximately every 20 years.



Soil Binder Pathway Under Construction

Alternative Pavement Surfaces for Multi-use Trails

Concrete - Concrete is widely used as a surface material for sidewalks and paths. It is readily available and can be installed by most contractors. Concrete pathways last a very long time. However, they can be visually intrusive, especially in natural areas, they are impermeable and they are subject to root heaving and can be difficult to repair.

Maintenance required for concrete walks is far less than for any of the other pathway surfaces reviewed. It includes sweeping or blowing at regular intervals and occasional weed eradication. A properly installed concrete walk can easily last over 100 years. Root heaving from nearby trees can be problematic and when repairs are required, they are typically more expensive than for other surfaces.

Crushed Aggregate – Crushed aggregate is widely used as a surface for paths, however it is not often used on multi-use paths because it restricts use by rollerblades and skateboards. A well compacted aggregate path can be used for most strollers and wheelchairs. Aggregate is readily available and can be installed by most contractors. The more it is compacted to support more users, the lower is its permeability.



Crushed Aggregate Pathway in Coquitlam

Maintenance required for crushed aggregate walks includes blowing off debris at regular intervals, frequent weed eradication, repairing damaged spots approximately once per year, minor resurfacing approximately once every 4 to 5 years, and installing a new lift approximately every 10 years.

Crushed Concrete – Crushed concrete is similar to the crushed aggregate listed above. It is commonly used in Coquitlam for surfacing various types of paths because there are local sources, which makes it a low-cost solution for this area. Like crushed aggregate, it is not often used on multi-use paths because it restricts use by rollerblades and skateboards. There is potential to combine crushed aggregate/concrete pathway surfacing with one of the soil binders to accommodate all wheeled devices.



Crushed Concrete Pathway in Coquitlam

Maintenance required for crushed concrete walks is very similar to crushed aggregate listed above.

Alternative Pavement Surfaces for Multi-use Trails

Pavers – Pavers are expensive, but can be an attractive pathway surface in urban areas. The surface offers a bumpy ride for Rollerbladers and skateboarders, but does not necessarily restrict their use. This document refers to installation of pavers over a well compacted granular and sand base.

Maintenance required for paver walks includes sweeping or blowing off debris at regular intervals, frequent weed eradication, and repairing damaged spots approximately once per year. Pavers tend to require much more maintenance than asphalt and concrete due to weed growth. However, repairs to pavers are relatively simple and are typically less expensive than asphalt or concrete repairs. Pavers are nearly impermeable.



Paver Walkway with Planters



Paver Driveway

Permeable Pavers – Permeable pavers consist of interlocking concrete paving blocks separated by holes that are filled with soil and gravel. These pore spaces allow infiltration of stormwater into a properly designed storage facility below the surface. Permeable pavers offer the same attractive pathway surface appropriate for urban areas, but would probably restrict the use of rollerblades and skateboard. Other wheeled devices like bicycles and wheelchairs would be able to use this surface.



Permeable Paver Driveway



Detail of Permeable Pavers

Alternative Pavement Surfaces for Multi-use Trails

Maintenance required for permeable paver walks would be similar to paver walks except that weed eradication would be required more frequently and occasional sweeping or vacuuming of voids would be required to maintain their permeability.

Appendix

Following is a list of articles:

Andrew Giles Thesis, "Exploring the Social, Environmental and Economic Aspects of Trail Surfacing Decisions – 2002"

Landscape Architecture Magazine, July 2001, Volume 91, Number 7, "Paving Alternatives"

Stormwater Magazine, 2002 "Green Roads: Research Into Permeable Pavers"

Stormwater Magazine, 2002 " Porous Pavement"

Following is a list of contacts made:

Jeff Tsuyuke – Burnaby Engineer

Sean Gurney – Urban Forestry Technician City of Surrey

John Sidnell – Engineer Citiwest Consulting

Bob Paterson – Parks Construction City of Surrey

Eric Emery – Engineer Burnaby Mountain

Brian Kohlen – Cedar Crest Landscape Contractors

Randy White – Grounds Keeper Everett Washington Country Club

Andrew Giles – Community Development Coordinator Surrey

Sergio Barot – Poly Pavement Representative

Bill Paprocki – Stabilizer Solutions Representative

Ron Lapoint – Coquitlam Trail Construction

Following is a list of products:

Stabilizer Solutions

Poly Pavement

Road Oyl



City of Coquitlam

Appendix IV – Bear Attractant Plants



Coquitlam

Wildlife Friendly Landscaping – A Guide for Professionals

<http://www.bearsmart.com/docs/wildlife-friendly-landscaping-professionals.pdf>

<http://www.bearsmart.com/becoming-bear-smart/home/managing-attractants>

In Whistler, there is a strong focus on improving and creating wildlife habitat in backyards and green spaces. Wildscaping undoubtedly has positive ecological value; but in our area, improving wildlife habitat can also mean attracting bears into conflict situations. This guide will help you manage such considerations without negatively impacting landscape design and the ecological integrity of your project.

While bears are a part of Whistler's natural environment, enticing them close to our homes either with food sources like garbage or birdseed, or landscaping that provides food for bears, may create conflict and be detrimental not just for bears, but for the community as well. Landscapers, landscape architects, arborists, nursery suppliers, and developers all play key roles in ensuring that we don't draw bears into commercial, residential or developed areas.

Like us, bears learn from their experiences. Once bears learn where food is, they are likely to keep coming back. This kind of learning is called "food conditioning". Animals that become conditioned to accessing food in human-use areas are at greater risk of getting into conflict and being killed to protect people and their property. While the risk of human injury by a bear in a backyard, green space or developed area is relatively small, it makes sense not to gamble with safety.

Fruit-bearing trees and shrubs, like mountain-ash in particular, are an easy source of calories for a bear, and are of concern in landscaped areas of Whistler. Bears are driven by the biological need to accumulate weight before they den in the fall, entering a state of hyperphagia (a hyper-active feeding mode). Mountain-ash berries ripen during this time when most other berries have been depleted at lower elevations. The large clumps of mountain-ash berries provide for quick and easy feeding making them a prime choice for bears. The berries are also more nutritious after they have been frost affected maintaining their appeal throughout the winter and even the following spring. While this provides a prolonged and plentiful food supplies for bears, the plants are often found in undesirable places. The Get Bear Smart Society has been actively helping to remove mountain-ash in high conflict areas over the last few years, and has replaced them with non fruit bearing native species. The mountain-ash is then transplanted (when possible) to more suitable bear habitat well away from areas where bears can come into conflict with people. This helps draw bears out of the Valley bottom and away from developed areas. Areas where landscaped bear foods have been removed have experienced a significant decrease in human-bear conflict and property damage.

"Our mountain-ash trees at the base of Blackcomb compromised our conservation principals by encouraging bears into high traffic areas. Removal of these trees was the only suitable resolve".

Arthur DeJong, Environmental Resource Manager,
Whistler Blackcomb Mountains

There are several factors that need to be taken into account when determining the attractiveness of landscaping to bears:

- ripening season i.e. berries that ripen during a season when other wild foods are plentiful are of less concern
- crop abundance i.e. the more abundant the production of berries, the more attractive the plant is to bears; clumped berries are far more attractive than those that are widely spread over the branches
- planting density i.e. if planted alone, bushes like red-osier dogwood are not that attractive to bears; if however, they are planted in high densities, for example to form a hedge, they will be much more attractive
- location of plant i.e. is it next to a building entrance-way, beside a window/door, near children's play set; beside a driveway, path, road or other high use human area?

- amount of human use in the area i.e. the quieter the area, the more likely a bear will investigate
- proximity to cover or wild space; plants adjacent to wild spaces and tall trees that bears can use for security cover might not be as much of an issue

We recommend that you use a common sense approach to landscaping, taking into account all wildlife and environmental considerations. It is possible to find a middle ground that addresses most issues of concern. For example, birds prefer sour berries to sweet ones and most love juniper berries; while bears like the sweet ones and don't like juniper berries. This is just one example of how we can still provide food for birds while discouraging bears at the same time.

There are many native plant species that don't attract bears and are a great addition to any backyard, green space, or development. Native plant species enhance biological diversity; provide refuge and habitat for wildlife; compensate for land lost to urban sprawl and land conversion, and sequesters carbon to offset CO2 emissions. Vegetation also plays a critical role along streams where the plants can filter runoff; aid in flood control; and provide wildlife corridors.

These plants are NOT recommended due to their attractiveness to bears: mountain-ash varieties, rowan tree (*Sorbus spp.*), black and red huckleberries, blueberries (*Vaccinium spp.*), saskatoon berry (*Amelanchier alnifolia*), salmonberry (*Rubus spectabilis*), soapberry (*Shepherdia canadensis*), wild rose (*Rosa pisocarpa*), red-osier dogwood (*Cornus stolonifera*), choke cherry (*Prunus virginiana*), kinnikinnick (*Arctostaphylos uva-ursi*), and salal (*Gaultheria shallon*).

All bear attracting plant species identified on the above list are rated as "high". Many other plants also attract bears (such as domestic crops of fruit, berries, and many other native species) A complete list including plants that are rated as medium and low attractants can be found on www.bearsmart.com under Habitat Management or Bear Smart Whistler - Brochures.

The list below suggests some great native plants that enhance wildlife values but do not attract bears. These are just a few examples; there are many other options. All sites are different and have different requirements.

These plants ARE recommended as alternatives as they are not known to attract bears: Douglas maple (*Acer glabrum*), mock orange (*Philadelphus lewisii*), Davidson's penstemon (*Penstemon davidsonii*), Pacific ninebark (*Physocarpus capitatus*), sweet gale (*Myrica gale*), large leafed lupine (*Lupinus polyphyllus*), snowbrush (*Ceanothus velutinosus*), goats beard (*Aruncus sylvestris/dioicus*), hardhack (*Spirea douglasii*), willow species (*Salix spp.*), falsebox (*Pachystima myrsinites*), foam flower (*Tiarella trifoliata*) and red columbine (*Aquilegia formosa*).

For additional information on native plant species in Whistler, please refer to:

J. Pojar and A. MacKinnon, 1994. Plants of Coastal British Columbia.
 Whistler Biodiversity Project www.whistlerbiodiversity.ca under species list - plants native.
 Varner, C. 2002. Plants of the Whistler Region.
 Resort Municipality of Whistler - Landscape & Horticulture Department

Are you landscaping/contracting for a private property? Take things a step further by considering these tips for reducing bear visits to your client's backyard:

- Remove plants that bears like to eat, especially ones located in areas where we don't want to find bears feeding i.e. next to building entrance-ways, beside windows/doors, near children's play sets; beside driveways, paths, roads and other high use human areas. Plants located away from houses or at the edge of properties may be removed at the client's discretion, depending on the site's potential for human-bear conflict (for the clients and their neighbours). If you or your clients are in doubt, we would be happy to do a site visit and make recommendations.

- Do not apply bone meal or fish fertilizer to gardens – instead use compost or composted manure.
- Avoid seeding with clover, especially along roadways. Cut grass often and keep the lawn free of dandelions – a favourite food for bears.
- Recommend electric fencing to effectively deter bears from orchards, gardens and compost; or suggest that produce is harvested when ripe. This is actually the law in Whistler: Garbage Disposal and Wildlife Attractants Bylaw No.1861, 2008 – Section 20.
- In cases where fruit trees may be "relict" or antique representing increasingly rare genetic stock; ensure that fruit is removed as it ripens and is not left to rot on the ground. Prune back branches as much as possible.

Other tips for wildlife-friendly gardening:

- Avoid the use of invasive plant species¹ which outcompete native species and contribute to decreased biodiversity. Native species provide richer habitat for wildlife.
- Avoid using herbicides, pesticides and fungicides. These products often have detrimental effects on untargeted living organisms (for example, snail bait can also kill other invertebrates). Use mechanical methods to remove unwanted vegetation – in Whistler it is actually the law! Check out RMOW Bylaw 1822, 2007 that regulates cosmetic non-essential pesticides.
- Avoid using synthetic fertilizers. Animals have been known to ingest synthetic fertilizers resulting in liver damage and even death (including pet dogs and cats). These fertilizers also contribute to high nitrogen levels in lakes and streams. This can be detrimental to aquatic life. Instead, use manure, compost and bark mulch.
- Do not use a chemical spray to thin or abort fruit from forming on trees and berry bushes. These sprays can be deadly for bees and other invertebrates.

Additional resources:

Get Bear Smart Society: See our website at www.bearsmart.com/becoming-bear-smart/home/managing-attractants.

www.bearsmart.com e: info@getbearsmart.com ph: 604-905-4209

Peel's Nursery (Native Plant Material) www.peelsnurseries.com

Sea to Sky Invasive Species Council www.ssisc.info

City Farmer (vermicomposting) www.cityfarmer.org/wormcomp61.html

Brought to you by:



Get Bear Smart Society
PO Box 502, Whistler, BC V0N 1B0
e: info@bearsmart.com ph: 604-905-4209



*Be the leader you know you can be,
by having a wildlife friendly back yard,
and encouraging your neighbors to do the same!*

¹ Examples of invasive species that are often planted in backyard landscaping include: scotch broom, foxglove, Japanese knotweed, yellow flag iris, lamium, yellow loosestrife, purple loosestrife, curled pondweed (submerged aquatic), Himalayan blackberry, periwinkle, policeman's helmet and English ivy.

Bear Attractant Plants to Avoid

Excerpts: City of Coquitlam, Bear Hazard Assessment Report, 2007

List of potential foods (natural attractants) for black bears in the South Coast Mountains

Wayne McCrory, RPBio, Bear Biologist

McCrory Wildlife Services Ltd.

Box 479, New Denver, British Columbia V0G 1S0

Phone: 250-358-7796; e-mail: waynem@vws.org

[Adapted, with permission, from Squamish Bear Plan, 2006, by McCrory and Paquet]

Table 1. Grizzly and black bear habitat and food table form used for habitat evaluation. BC South Coast Mountains and North Cascades (BC Parks bear hazard studies). This list of potential, preferred, incidental, and questionable bear foods is preliminary. Most but not all have been identified in these mountain ranges. A question mark (?) indicates questionable identity or presence. Common and Latin names follow Pojar and MacKinnon (1994) where possible.

Species	%	Bear Use	Phenology	Notes
FORBS				
Ballhead waterleaf? (<i>Hydrophyllum capitatum</i>)				
Baneberry (<i>Actaea rubra</i>)				
Blunt-fruited sweet-cicely (<i>Osmorhiza depauperata</i>)?				
Clover spp.				
Common dandelion (<i>Taraxacum officinale</i>)				
Common horsetail (<i>Equisetum arvense</i>)				
Cow-parsnip (<i>Heracleum lanatum</i>)				
Edible thistle (<i>Cirsium edule</i>)				
Thistle spp.				
False Solomon's-seal (<i>Smilacina racemosa</i>)				
Fendler's waterleaf (<i>Hydrophyllum fendleri</i>)				
Hooker's fairybell (<i>Disporum hookeri</i>)				
Indian hellebore (<i>Veratrum viride</i>)				
Kneeling angelica (<i>Angelica genueflexa</i>)				
Lady fern (<i>Athyrium filix-femina</i>)				
Lovage? (<i>Ligustichum</i> spp.) (not observed)				
Mountain sorrel (<i>Oxyria digyna</i>)				
Mountain sweet-cicely (<i>Osmorhiza chilensis</i>)				
Other fern spp.				
Other horsetail spp.				
Rosy twistedstalk (<i>Streptopus roseus</i>)				
Skunk cabbage (<i>Lysichiton americanum</i>)				
Star-flowered false Solomon's-seal (<i>Smilacina stellata</i>)				
Stinging nettle (<i>Urtica dioica</i>)				
Western meadowrue (<i>Thalictrum occidentale</i>)				
Other forbs				

Bear Attractant Plants to Avoid

Excerpts: City of Coquitlam, Bear Hazard Assessment Report, 2007

GRASSES (Poaceae)				
Hairgrass spp.				
SEDGES (<i>Carex</i>)				
Lyngby's sedge (<i>Carex lyngbyei</i>)				
ROOTS & CORMS				
Arctic lupine (<i>Lupinus arcticus</i>)				
Brandgee's lomatium (<i>Lomatium brandegei</i>)				
Cow-parsnip (<i>Heracleum lanatum</i>)				
Desert-parsley (<i>Lomatium dissectum</i>)				
Mountain sweet-cicely (<i>Osmorhiza chilensis</i>)				
Skunk cabbage (<i>Lysichiton americanum</i>)				
Sweetvetch (<i>Hedysarum</i> spp.)				
Western spring-beauty (<i>Claytonia lanceolata</i>)				
Yellow glacier lily (<i>Erythronium grandiflorum</i>)				
Other lily				
BERRIES				
Bitter cherry (<i>Prunus emarginata</i>)				
Black currant (<i>Ribes lacustre</i>)				
Black hawthorn (<i>Crataegus douglasii</i>)				
Black huckleberry (<i>Vaccinium membranaceum</i>)				
Black twinberry (<i>Lonicera involucrata</i>)				
Blueberry spp. (<i>Vaccinium alaskaense</i> , <i>V. ovalifolium</i>)				
Bog blueberry (<i>Vaccinium uliginosum</i>)				
Bog cranberry (<i>Oxycoccus oxycoccos</i>)				
Crowberry (<i>Empetrum nigrum</i>)				
Devil's club (<i>Oplopanax horridus</i>)				
Dull Oregon grape (<i>Mahonia nervosa</i>)				
Dwarf or Cascade blueberry (<i>Vaccinium caespitosum</i>)				
Evergreen huckleberry (<i>Vaccinium ovatum</i>)				
Grouseberry (<i>Vaccinium scoparium</i>)				
Hairy manzanita (<i>Arctostaphylos columbiana</i>)				
Highbush cranberry (<i>Viburnum edule</i>)				
Indian plum (<i>Oemleria cerasiformis</i>)				
Kinnikinnick (<i>Arctostaphylos uva-ursi</i>)				
Mountain cranberry, or lingonberry (<i>Vaccinium vitis-idaea</i>)				
Red elderberry (<i>Sambucus racemosa</i>)				
Red huckleberry (<i>Vaccinium parvifolium</i>)				
Red raspberry (<i>Rubus idaeus</i>)				
Red-osier dogwood (<i>Cornus stolonifera</i>)				
Salal (<i>Gaultheria shallon</i>)				

Bear Attractant Plants to Avoid

Excerpts: City of Coquitlam, Bear Hazard Assessment Report, 2007

Salmonberry (<i>Rubus spectabilis</i>)				
Saskatoon, or Serviceberry (<i>Amelanchier alnifolia</i>)				
Sitka mountain ash (<i>Sorbus sitchensis</i>)				
Soopolallie (<i>Shepherdia canadensis</i>)				
Sticky currant (<i>Ribes viscosissimum</i>)				
Stink currant? (<i>Ribes bracteosum</i>)				
Tall Oregon grape (<i>Mahonia aquifolium</i>)				
Thimbleberry (<i>Rubus parviflorus</i>)				
Western mountain-ash (<i>Sorbus scopulina</i>)				
Wild rose (<i>Rosa</i> spp.)				
<u>NUTS</u>				
Beaked hazelnut (<i>Corylus cornuta</i>)				
Whitebark pine (<i>Pinus albicaulis</i>)				
<u>SPRING BUDS</u>				
Willow, cottonwood buds in spring (M. Allen pers. comm.)				
<u>MAMMALS</u>				
Beaver (<i>Castor canadensis</i>)				
Black-tailed deer (<i>Odocoileus hemionus</i>)				
Columbian ground squirrel (<i>Spermophilus columbianus</i>)				
Marmot spp.				
Moose (<i>Alces alces</i>)				
Mountain beaver (<i>Aplodontia rufa</i>)				
Mountain goat (<i>Oreamnos americanus</i>)				
Rocky mountain elk (<i>Cervus canadensis</i>)				
Other				
<u>FISH</u>				
Trout				
Salmon				
<u>INSECTS</u>				
Ants (e.g., Carpenter ant (<i>Camponotus pennsylvanicus</i>))				
Wasps				
Army cutworm moth (<i>Euxoa auxiliaris</i>) ? – alpine talus habitat				

Bear Attractant Plants to Avoid

Excerpts: City of Coquitlam, Bear Hazard Assessment Report, 2007

APPENDIX 5

Preliminary list of plants used for landscaping purposes that attract black bears (non-natural attractants)

[The following information is supplied by Wayne McCrory, RPBio, McCrory Wildlife Services, and is adapted from letter to Sylvia Dolson, GetBearSmart Society, Whistler, BC, dated 5 August 2004.]

Black bears are attracted to developed areas to forage on plant species at landscaped sites or, alternatively, to forage on native plants that have been allowed to continue to grow wild. Bear use of various plant foods in developed areas has been fairly well-documented in the South Coast region.

Commonly observed species/subtypes used in landscaping and that attract bears are as follows:

- domestic varieties of rose (*Rosa* spp.) - feed on rose hips in late summer and fall, and possibly spring
- mountain-ash (*Sorbus* spp.) shrubs and trees - feed on berries in late fall
- salal (*Gaultheria shallon*) – feed on berries in late summer
- varieties of Oregon grape (*Mahonia* spp.) – feed on berries in summer
- kinnikinnick (*Arctostaphylos uva-ursi*) also called bearberry - feed on berries in fall and spring; berries can stay on shrubs over the winter and increase their sugar content
- red-osier dogwood (*Cornus stolonifera*) - feed on the white berries that ripen in August
- black twinberry, also called bearberry honeysuckle (*Lonicera involucrata*) – feed on berries in early-mid summer
- (unidentified) cherry (*Prunus* spp.) and others
- Fruit tree varieties (apples, plums, pears, etc.)
- clover (*Trifolium* spp.) – used in lawns and grows wild – graze on, particularly in spring
- decorative sedges (Cyperaceae) and grasses (Poaceae) used in lawns, gardens, and to edge landscaped ponds – feed on in spring and early summer

In some cases, particularly during the very late fall, some black bears appear to be relying almost entirely on berry foods that are available in developed areas. Most native (and many non-native) berry-producing shrubs and several varieties of fruit trees are available commercially.

Lawns and other artificially planted green vegetation are a major attractant in some areas, such as golf courses, but I don't think much can be done about this except to encourage different types of growth or surface materials that do not attract bears.

Naturally occurring bear foods in developed areas

In many areas, extensive tree cover and associated understorey have been left undisturbed in subdivisions and other developed areas that create a relatively comfortable living space for more habituated black bears. There are a great variety of naturally occurring shrub species that provide berries utilized by black bears. Some of these species are similar, or identical, to those introduced at artificially landscaped sites.

In terms of berry-producing wild trees and shrubs that attract bears, it is difficult to know how to address this widespread natural bear attractant. I would suggest that planners/homeowners/developers consider clearing understorey shrubs that produce berries for at least a 50 m radius surrounding schools, children's parks ("tot lots"), dwellings, and backyard play areas. Huckleberries and blueberries (*Vaccinium* species) are the most common and highly desired by bears.

Bear Attractant Plants to Avoid

Excerpts: City of Coquitlam, Bear Hazard Assessment Report, 2007

The following is a partial list of berry shrubs:

- Red Huckleberry (*Vaccinium parvifolium*)
- Black Huckleberry (*Vaccinium membranaceum*)
- Oval-leaved Blueberry (*Vaccinium ovalifolium*)
- Alaskan Blueberry (*Vaccinium alaskaense*)
- Dwarf Blueberry (*Vaccinium caespitosum*)
- Black Twinberry, also called bearberry honeysuckle (*Lonicera involucrata*)
- Saskatoon (*Amelanchier alnifolia*)
- Salmonberry (*Rubus spectabilis*)
- Thimbleberry (*Rubus parviflorus*)
- Black Gooseberry, also called black swamp gooseberry (*Ribes lacustre*)
- Stink Currant (*Ribes bracteosum*)
- Red Elderberry (*Sambucus racemosa*)
- Highbush-Cranberry, also called Squashberry, Mooseberry (*Viburnum edule*)
- Red-Osier Dogwood (*Cornus stolonifera*)
- Wild Rose (*Rosa pisocarpa*)
- Devil's Club (*Oplopanax horridus*)
- Salal (*Gaultheria shallon*)
- Kinnikinnick, also called common bearberry (*Arctostaphylos uva-ursi*)
- Sitka Mountain Ash (*Sorbus sitchensis*)
- Choke Cherry (*Prunus virginiana*)
- Soopolallie, also called Soapberry, Canadian Buffalo-Berry (*Shepherdia canadensis*)
- Black Raspberry, also called blackcap (*Rubus leucodermis*) [occurs but is not native]

Trees and shrub cover

Since black bears are forest creatures, they like to have trees for “security” to escape by climbing when they feel threatened. Bears also feel more comfortable in dense cover than in more open areas. Most black bears appear not to venture into wide open areas for more than 50 m from trees and shrub cover, but some large male bears will do so.

Homeowners or landscapers might consider thinning trees and native cover near homes and yards, and even removing downed logs that provide ants and other insect larvae for bears to eat. They should be more careful in planting new trees and/or shrubbery, such as birch and spruce, that will provide enhanced cover and security for black bears. They might wish to plant trees that remain small or can be trimmed back, and space out new shrubbery to leave good visibility. Also, dense shrubbery should not be planted close to a house, any children’s backyard play areas, schools, or businesses.

In some ways, keeping areas next to homes more free of perimeter trees and shrubs will also increase the “FireSmart” value of protecting homes and businesses in the event of an uncontrolled wildfire.

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August 5, 2004

[Used, with permission, from *Squamish Bear Plan*, 2006, by McCrory and Paquet]

Whistler Bear Food Plant List

Whistler Bear Food Plants

Plants ranked "very high" and "high" are particularly attractive to bears as a source of food and are not recommended to be planted in areas where people gather; near children's playgrounds; along busy pedestrian pathways; or next to entrance-ways.

NATIVE SPECIES	NON-NATIVE SPECIES	Attractant Rating	
Sorbus spp		Very High (fall)	Mountain-ash
Vaccinium spp		Very High (summer)	Blueberry/Huckleberry
	Clover, alfalfa, dandelion	High (spring)	
Cornus stolonifera		High	Red-osier dogwood
Amelanchier spp		High	Saskatoon berry, Service berry
Oplopanax horridus		High	Devil's club
Rubus spectabilis		High	Salmonberry
Gaultheria shallon		High	Salal
Rosa pisocarpa		High	Wild rose
Shepherdia canadensis		High	Soopollalie, soapberry
Native horsetail, grasses, sedges		High, Medium	
	DOMESTIC FRUIT TREES	High	All species
	Aronia melanocarpa	High	Black chokeberry
	Rubus Discolor	High	Himalayan blackberry Invasive species
Viburnum edule		Medium	Highbush-cranberry
Ribes bracteosum		Medium	Stink current
Ribes lacustre		Medium	Black gooseberry/swamp gooseberry
Ribes sanguineum		Medium	Red-flowering currant - also hosts pine blister rust
Prunus virginiana		Medium	Choke cherry
Rubus idaeus		Medium	Red raspberry
Lonicera involucrate		Medium	Black twinberry
Sambucus racemosa		Medium	Red elderberry
Prunus emarginata		Medium	Bitter cherry
Rubus ursinus		Medium	Trailing blackberry
Rubus parviflorus		Medium	Thimbleberry
Malus fusca		Medium	Pacific crab apple
Empetrum nigrum		Medium	Crowberry
Oemleria cerasiformis		Medium	Indian plum
Crataegus douglasii		Medium	Black hawthorn
Arctostaphylos uva-ursi		Medium (fall)	Kinnickinnick
Rubus leucodermis		Low	Black raspberry
Oxycoccus oxycoccus		Low	Bog cranberry
Corylus cornuta		Low	Beaked hazelnut
Mahonia nervosa		Low	Dull Oregon-grape
Mahonia aquifolium		Low	Tall Oregon grape
Mahonia repens		Low	Oregon grape
Fragaria virginiana		Low	Wild strawberry
Rosa nutkana		Low	Nootka rose
Rosa gymnocarpa		Low	Baldhip rose
Symphoricarpos alba		Low	Common snowberry
Rubus pedatus		Low	Five-leaved bramble
Lysichiton americanum		Low	Skunk cabbage
Prunus padus			European bird cherry
Berberis thunbergii DC.			Japanese barberry
Ribes alpinum			Alpine currant
Rosa medilland			Medilland rose
Rosa rugosa			Pavement rose
Viburnum burkwoodii			Burkwood viburnum
Mahonia x media			Holly grape
			Potential bear food. Status unknown. Best to avoid.
			Potential bear food. Status unknown. Best to avoid.
			Potential bear food. Status unknown. Best to avoid.
			Potential bear food. Status unknown. Best to avoid.
			Potential bear food. Status unknown. Best to avoid.
			Potential bear food. Status unknown. Best to avoid.
			Potential bear food. Status unknown. Best to avoid.
			Potential bear food. Status unknown. Best to avoid.

NOTE: This list is not exhaustive. There may be other plants, native and non-native that bears will use opportunistically.



City of Coquitlam

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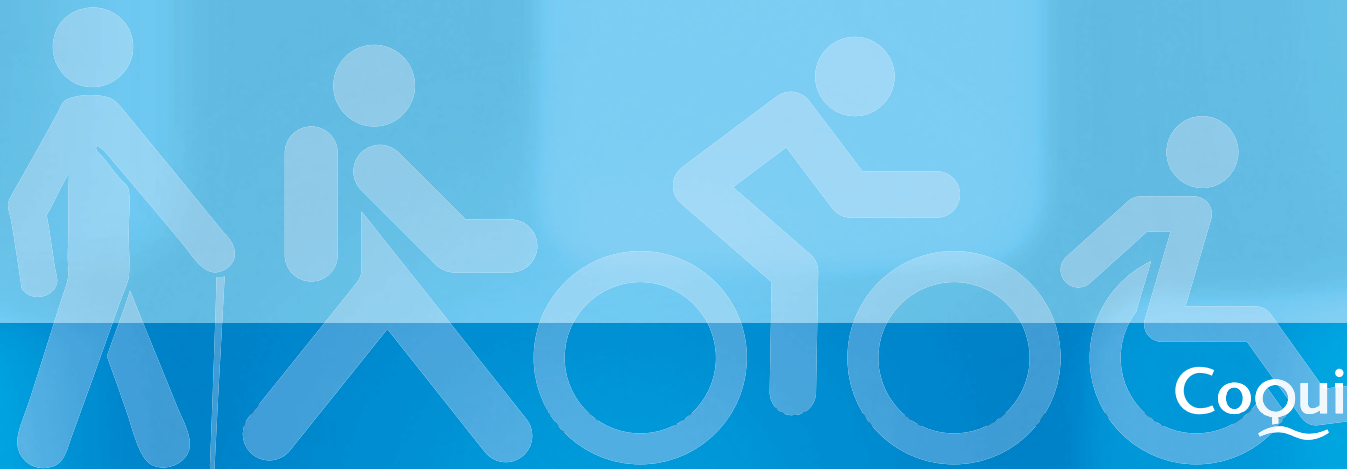
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