City of Surrey

Parks, Recreation and Culture Department

Natural Areas: Access and Recreation

Management Strategy

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Introduction: Balancing Nature and Community

Benefits and Challenges

Within Surrey's park system substantial portions of natural areas have been set aside to ensure preservation and to provide outdoor recreational opportunities for residents and visitors. Public use and enjoyment of these natural areas is becoming increasingly popular, as more and more people choose to seek outdoor recreational pursuits in a natural setting.

Responsible planning and management of these natural areas provide significant benefits to both the environment and the public:

- Protection and preservation of natural habitats
- Preservation of ecological connectivity
- Safe, enjoyable access to areas of interest or solitude
- Increased opportunities for high demand recreational activities
- Increased educational and social opportunities
- Increased tourism opportunities
- Alternative, healthier transportation options

The greatest challenge currently facing managers of natural areas is the task of fulfilling both the environmental mandate to protect and preserve sensitive ecosystems, and to provide for the recreational demands and needs of park users. While sensory experiences, solitude and exercise are some of the important values provided to users of natural areas, these recreational activities can be disruptive and even destructive to natural systems. Natural area access and recreation management plans must attempt to weigh the value of human experience and balance it against the negative impacts on the parks' ecosystems. This *Access and Recreation Management Strategy* will assist in reasonable and consistent decision-making that will stand up to the light of public scrutiny.

A significant portion of this Strategy is devoted to the provision of trails. As the primary method of access to natural areas, trails are becoming increasingly popular and well used. According to a public survey conducted for the *Parks, Recreation and Culture Master Plan* (1996-2006), of those respondents who wanted additional outdoor recreational facilities 56% favoured an increase in the number of walking and cycling trails. This makes trails the most requested outdoor facility within the Surrey park system. Proper trail management is thus paramount with such high user demand. Ultimately an effective strategy must negotiate and consider a constellation of often non-compatible interests, including environmental protection, recreational, educational and social opportunities, and safety and personal security.

Purpose and Scope

The purpose of this strategy is to provide future direction and guidance for the Parks, Recreation and Culture Department and Parks Commission for the management of access and

recreation in natural area parkland. The strategy includes management principles, goals, and objectives that will assist in resolving recreational use issues while protecting and preserving these valuable areas.

The scope of this strategy covers the management of natural areas that have been acquired for public use and benefit. It includes decision making processes for access and recreation activities within natural areas, and general recommendations in the following areas.

- Access principles for natural areas
- Goals and objectives for access and recreation management of natural areas
- Provision for legitimate access and recreation activities
- Determination of sustainable activities
- Criteria and evaluation processes for developing trail networks
- Trail building and maintenance

Current Situation

The City of Surrey owns approximately 1, 550 hectares of natural area parkland with over 200 kilometers of trails and pathways. Historically, access to natural areas was provided by wildlife trails or by walking trails built by the First Nations and the non-native settlers. More recent trails have been built by City staff, land developers and private citizens.

Urbanization and development within the City have resulted in rapid loss of privately owned natural areas and have increased recreational use pressures on City-owned parks. A growing population of outdoor-oriented residents has led to significant increases in both sanctioned and unsanctioned recreational uses within natural areas. In particular, residents of nearby subdivisions have often created unsanctioned trails for walking and cycling within natural area parkland. These have had a significant impact on site ecology.

Further demands have been created by a steady increase in the number of dogs in natural areas. Shrinking yard sizes, and the trend to townhouse or condominium living have created a significant demand for areas where dogs can run free.

Degradation of natural areas has also resulted from, at times, inappropriate trail construction methods, combined with inflexible planning and a lack of funding. Responsible management of natural areas has become a serious challenge. Declining trail quality and increasing user demands have negatively impacted on overall recreational satisfaction. User conflicts have surfaced in many areas and demands for specific types of recreational experiences have not been consistently met.

In natural area parkland one of the most challenging and pressing access issues are user conflicts, safety, and encroachments into the parks. Specifically, they are as follows:

- Increased demand for access to natural areas for a wide variety of sometimes conflicting uses
- Occasional accidents involving cyclists striking walkers
- New recreational activities such as roller blading and off-road biking
- Increase in dog-related incidents: despite regulations requiring dogs to be leashed, dog owners often let their dogs run free, causing environmental degradation,

interference with wildlife, pollution from defecation and conflicts with other park users

- Increasing demand for dog off-leash areas
- Repeated concern expressed by residents over youths gathering in the relative obscurity of the forest cover
- Demands for trail closures when trails are close to private property or where trails are thought to provide convenient access for burglars
- Fence extensions by residents into the parks, claiming natural areas for their exclusive use at the expense of the general public or the area's ecology

The absence of a comprehensive set of recreational-use principles, goals, and objectives for natural areas has made it increasingly difficult for City staff or the Commission to resolve some of these issues. Contributing to this difficulty is a lack of current, up-to-date information on Surrey's natural area parkland. Existing maps are limited and lack detail on trail types and their distribution. Nor is there a comprehensive database that documents their size, location, condition or current recreational uses. Other aggravating constraints are limited resources, lack of trained personnel and inappropriate trail building.

The *Access and Recreation Management Strategy* will address these problems to ensure the City's natural areas are used and maintained in ways that provide long-term benefits to residents, while preserving the ecological values of natural areas.

Management Principles

The following principles are designed to guide the development of management goals and objectives, preparation of work plans, and resolution of associated issues.

- Natural areas are valuable ecosystems and must be respected
- Wildlife must be protected
- Natural areas are for the benefit of the general public and should be shared
- Fragmentation of natural areas must be limited when providing access
- Recreational activities must be compatible with the site and must not unduly impact significant habitats and vegetation
- Recreational activities at one site must be compatible with one another
- Access and recreation activities must be legitimate and authorized
- Access and recreation should be planned, monitored, and evaluated
- Regulations designed to protect natural areas should be developed and enforced

Management Goals and Objectives

The following goals and objectives are based on the above principals and are designed to protect and enhance natural areas while providing recreational opportunities for the community.

1. Preserve and protect natural area ecosystems

Natural areas provide crucial habitat for many different animals and often contain environmentally sensitive areas with rare and threatened vegetation. In cases where ecological values may be significantly compromised, access and recreation must be controlled, limited or even prohibited.

2. Provide legitimate access and recreational uses of natural area parks that meet the needs of Surrey residents of all abilities

Natural areas provide a unique environment for people to enjoy a diverse number of recreational activities. From low impact walking to high impact competitive cycling, recreational activities are increasingly in demand. Legitimate access and recreation must be planned and provided for in suitable areas in order to meet the needs of the general public.

3. Provide a high quality trail system for access to and recreation within natural areas

Since access and recreation within natural areas is primarily provided by trails, a high quality neighbourhood and community trail system is desirable. A trail strategy should provide the necessary guidance to develop safe access and recreation opportunities while protecting natural area ecosystems.

4. Comprehensively plan for access and recreational activities in natural area parks

A plan to provide legitimate and appropriate access and recreation uses for natural areas should be developed. The plan should consider access and recreation opportunities, the needs of neighbourhoods and communities, and the capacity of sites to sustain the desired recreational activities.

5. Involve the public in the planning, design, construction and maintenance of access uses and opportunities in natural areas

Public involvement in the management of natural areas will contribute to the development of high quality services that are relevant to the general public, and that generate public acceptance and satisfaction. Such participation in projects by the community can also create a sense of ownership, and encourage stewardship of natural areas.

6. Prepare and implement maintenance work plans that will facilitate safe use by the public

Maintenance work plans that will optimize the safety and security of the public should be prepared and implemented by qualified personnel in accordance with Parks Division Standards and Policies. For example, such plans should include trail inspections that will identify trip hazards and/or hazard trees and actions to correct these problems.

7. Prepare and implement maintenance work plans that safeguard the ecological values of natural areas compromised by legitimate or illegitimate access and recreation activities

Maintenance work plans should include trail inspections to prevent or correct damage to natural areas. For instance, when adjacent landowners encroach on public parks, they

should be required to remove the encroachments. Or when recreational activities damage natural habitats or vegetation, the trails should be closed.

8. Develop and maintain an inventory that will facilitate the *Access and Recreation Management Strategy*

Currently, there is no collection of baseline information on the location and types of existing recreational facilities (e.g. trails) within natural area parkland. A high priority should be placed on building an accurate inventory to facilitate the development of a comprehensive management plan.

Guidelines for Decision Making

The following guidelines are designed to assist in decision-making when planning and providing for access and recreation within natural areas.

The access and recreation activity must be legitimate; it must be:

- Legal—not contrary to any City policy or regulation
- Appropriate—within societal norms and standards
- Conducted safely—without undue impact on the site ecology or on other users
- Needed and in demand
- Suitable for the site: the impact of the activity should not jeopardize the site:
    - low impact includes walking, bird watching, jogging, hiking, education, ecological interpretation, photography and painting, wildlife viewing, contemplating, roller blading, skateboarding, orienteering
    - high impact includes recreational and competitive cycling or horse riding
- For the benefit of the general public
- Not in conflict with other activities

The park site must have the carrying capacity to provide for the access or recreation activity. Assessments to determine carrying capacity should include:

- Environmental sensitivity
- Wildlife values, vegetation, soil and soil hydrology, park size and site conditions
- Impact of any proposed activities on the site ecology
- Historical uses
- Heritage values and potentials

The public will be consulted when:

- The access or recreation activity directly affects residents living nearby
- The access or recreation activity directly affects existing users
- The planning process would benefit from public input
- The proposed access or recreation activity is controversial or contrary to the norm for natural areas
- Commission and/or Council calls for public consultation

Access or recreation activities that are part of an approved service for a neighbourhood or community within the City will include a review of the following:

- Neighbourhood and community trail, access and recreation plans that have been determined through approved planning processes
- Greenways plans
- Hearts in Motion initiatives
- Trans Canada Trail plan
- B.C. Parkway plan
- Bicycle Blueprint plan
- Other approved trail and pathway plans
- Other plans and policies for natural areas (e.g. Sunnyside Acres, Green Timbers, Blackie Spit)

Part 1: Trail Strategy

Purpose and Scope

This strategy is designed as a reference guide to facilitate the development and sustainability of a high quality, cost effective trail system in Surrey's natural area parkland. It is designed to maximize user safety and enjoyment, minimize or reverse environmental damage, and reduce long-term costs.

It provides recommendations on the following:

- Planning and setting objectives
- The public
- Trail classification
- Trail inventory
- Trail development: design and construction
- Trail operation and maintenance
- Trail closures
- Trail safety and security

Planning and Setting Objectives

Trails serve Surrey residents as their major vehicle for access and recreation opportunities in natural areas. Because trail systems depend on the connectivity of natural areas, long-term planning is necessary in order to preserve appropriate lands before they are lost to development. The creation of a natural trail system in an already urbanized environment is much more difficult than retaining an appropriate land base prior to development.

Trail construction and maintenance will be more cost-effective and user-friendly if site access and recreation management objectives have been established first; then appropriate construction procedures can be determined. This entails identification and inventory of trails, clear definition of management concerns, accurate forecasting of work schedules, and the acquisition of the necessary resources.

The main planning and administration issues are the need for a clear set of goals and objectives, and for detailed maps and inventories. Without these, it has been difficult in the past, to plan and carry out development, maintenance and construction activities. Compounding this general difficulty has been unnecessary confusion arising out of the many different trail classification systems.

Objectives

- Conduct a comprehensive inventory of all existing trails, including unsanctioned trails—locations, types and conditions
- Identify legitimate site-specific access and recreation activities for each natural area park and ensure these uses are clearly defined when developing trail systems
- Develop a standard trail classification system

- Design trails in ways that minimize disruption or degradation of the park ecology
- Consider natural area habitat protection, recreational uses, and community needs when planning trails
- Ensure natural areas are managed by appropriate experts
- Develop protocols to ensure communication and consultation between the Parks Division and the Planning, Research and Design Section

The Public

Trail management must address issues of particular relevance to the public: the increasing numbers of unsanctioned trails created by the general public without consultation or official approval, and an increase in conflicts associated with trail uses. Responses to these issues include public involvement in planning, monitoring and maintenance, and special use trails for activities such as off-road technical biking and off-leash dog exercising.

Recommendations

- Include deactivation of unsanctioned trails in work plans
- Consult the general public regarding the planning, monitoring and maintenance of trails
- Encourage volunteer organizations and promote trail stewardship
- Consider user needs when developing, constructing or maintaining trails
- Develop technical biking trails in consultation with user groups
- Develop off-leash areas for dogs (dog parks) in consultation with user groups

Trail Classification and Development

A trail classification system is necessary to develop construction standards and maintenance specifications, which in turn, will be used to accomplish the following goals.

- Build trails that meet access and recreation objectives
- Allow land managers to prioritize and schedule their maintenance and inspection programs more efficiently
- Allow planners to more accurately assess the existing trails and paths within the City
- Provide predictable user experiences
- Use appropriate construction and maintenance techniques
- Allow users to choose a trail that best suits their needs

Definitions

Tread area–the traveled portion of the trail.

Trail–a travel corridor through a natural landscape that is built primarily for pedestrians, bicycles, wheelchairs, horses or scooters. These trails are not suitable for cars or trucks, but could be accessed by smaller vehicles such as ATVs.

Trail specifications include:

- Tread areas no more than 2.5 metres wide, possibly as narrow as 0.5 metres wide
- Surfaces primarily of natural mineral materials (rock), bark or wood mulches, native soils or environmentally safe cementing materials
- Surfaces of pavement or concrete occasionally, to accommodate recreation activity, reduce maintenance costs or protect the natural areas vegetation

Path–travel corridor to provide access primarily for large service vehicles such as trucks and fire fighting equipment, but can also be used by pedestrians, cyclists, skaters, people in wheelchairs, horses and scooters; a specialized recreation pathway built to accommodate high- and multi- use.

Path specifications include:

- Surface areas usually two to four metres wide
- Surfaces of compacted mineral materials, asphalt, concrete or soil cement
- Tread base designed to bear more weight and accommodate heavy uses
- Suitable for road bicycles and skate wheels

Surveillance area–is the area on either side of a trail or path, which allows the user a clear line of surveillance. Surveillance areas help to prevent user injury by allowing the user to see others on the trail or path.

Surveillance area specifications include:

- Specialized vegetation management such as vegetation pruning, removal, and brushing
- Appropriateness of size for the intended use—for example, a trail through a natural area that is used by children to get to school will require a larger surveillance area than a trail used by the general public to enjoy the natural surroundings.

Current Trail Classification System

The City needs a trail classification system that is consistent, complete, and a good fit for its specific types of trails. Currently, the informal trail classification system used in Surrey parks is incomplete and inconsistent. It employs more than one classification system and does not adequately describe the trail network.

For example, the Parks Division working document, *Maintenance Levels of Primary and Secondary Trails, Maintenance Standard*, classifies trails in Surrey as primary trails and secondary trails, while the informal Trails Inspection Program committee (1999) classifies park trails as primary walkways, secondary paths and natural trails. Additional trail and path types are referred to in a number of other documents covering green links, universal access trails, mountain bike trails, multi-purpose pathways, and engineering walkways.

Some municipalities have adapted existing trail classification systems from agencies such as the B.C. Ministry of Lands, Environment and Parks, but this is not a desirable route for Surrey. Such customized systems tend to oversimplify and omit certain types of trails or paths, resulting in an incomplete and inaccurate system.

The absence of an adequate trail classification system in Surrey is in marked contrast to the use of such systems by most large outdoor recreation-based agencies.

Trail and Path Uses in Surrey Natural Area Parks

Transportation or Service Access

These paths are usually three to four metres wide with asphalt or compacted crushed rock surfaces. They are incorporated into existing bikeways and greenlinks and are used as connectors between parks or schools and/or residential areas.

Recreation

Recreational trails and paths (both sanctioned and unsanctioned) are used for many activities including:

- Walking/dog walking
- Jogging/running
- Bicycle touring and racing
- Horseback riding
- Wheelchair or scooter riding
- Nature photography and interpretation
- Roller blading and skateboarding

The following proposed trail classification system provides guidance for planning, construction and maintenance of trail systems within Surrey's natural areas.

Trails should be classified according to intended access and recreation uses (e.g. mountain bike, equestrian, universal access, hiking) and usage rates (e.g. 0-25 users/day, 26-50 users per day). The intended uses and usage rates will dictate appropriate trail widths, construction specifications, vegetation management standards and maintenance levels.

General Use Trails

In Surrey's natural areas the most common trail types used by the general public are:

General Access and Recreation Trail

Designed for:

- Multi- and recreational use where the values of recreation activity and access requirements are primary, and the values of enjoying and appreciating nature are secondary
- Passage between destinations outside the park (e.g. from residential subdivision through a natural area to school)
- Most recreational needs and uses of the natural areas including recreational cycling, walking, hiking, etc.
- A steady flow of two-way pedestrian traffic
- Slow bicycle traffic (less than 10 km/h) to ensure pedestrians have the right-of- way
- High usage rates
- General passage for all ages

General design and construction specifications:

- Trail base constructed of coarse materials, and geotextiles when necessary
- Tread surfaced preferably with compacted crushed rock, wood shreds, bark mulch or combinations of these materials
- Occasionally surfaced with concrete or pavement (where appropriate)
- Tread area: 1.5 - 2.5 metres wide
- Surveillance area appropriate to the purpose of trail, type and amount of use, location, and potential personal risks; 1.0 - 4.0 metres on each side of the tread to a maximum of 10.5 metres wide including tread and surveillance area combined; vegetation within surveillance area is generally removed between .75 and 1.8 metres in height with the exception of tree trunks
- Overhead vegetation clearance height above the tread at a minimum of 2.5 metres
- Grades of 8%, with preferred grades of less than 5%

Recreational Nature Trail

Designed for:

- Explorative, recreation based walks where the values of the recreation activity and access use are equal to the values of enjoyment and appreciation for nature
- Single or double track variance depending on the site
- Medium usage rates
- Limited multi-uses
- Travel in pairs if personal security in the natural area is a concern

General design and construction specifications:

- Trail base of imported rock mulch or native mineral soils
- Tread surfaced with crushed rock, bark mulch, wood shreds or combinations of these materials
- Tread areas 1.0 -1.5 metres wide
- Surveillance area appropriate to the purpose of the trail, type and amount of use, location and potential personal risks; 1.0 - 2.0 metres on each side of the tread, to a maximum of 5.5 metres wide including tread and surveillance areas combined; vegetation within surveillance area is generally removed between .75 and 1.8 metres in height with the exception of tree trunks
- Overhead vegetation clearance height above the tread at a minimum of 2.5 metres
- Preferred average grades of 0-8%

Nature Trail

Designed for:

- Urban hiking experiences, where the values of enjoying and appreciating nature are primary, and the values of recreational activity and access use are secondary

- Experiences of solitude, meant to provide a feeling of escape from the urban environment and connection with the surrounding natural environment
- Nature interpretation
- Low use rates
- Single track use
- Connection to other trail types, but may be built as stand-alone entities
- Travel in pairs if personal security in the natural area a concern

General design and construction specifications:

- Tread area 0.5 - 1.0 metre wide, with vegetation managed only to prevent contact between the user and the vegetation
- Trail subgrade to consist of native soils or imported rock mulch
- Tread surface of crushed rock, bark mulch, wood shreds or combinations thereof
- Tread areas of stable native soils to be left bare as long as root protection, soil compaction and erosion issues are addressed
- No provision for surveillance area, line of sight only
- Overhead vegetation clearance height above the tread at 2.4 metres
- Trail grades no greater than 15% except for very short sections (less than 25 metres)

Special use Trails and Pathways

Universal Access Trails or Barrier Free Trails

Designed for:

- Unimpeded, relatively safe access for users of varying physical abilities
- Users who may be blind, visually impaired, deaf, have respiratory problems or mobility problems (e.g. confined to a wheelchair, require crutches or walking aids, or unsteady on their feet)
- All recreational uses, but primarily for users as described above

General design and construction specifications:

Design:

- Trails located close to other park facilities and parking lots
- Loop or stacked loop system to provide a 0.25 - 1.5 hour experience (Figure 2)
- Surveillance area appropriate to trail purposes, type, usage rates, location and potential personal risks
- Surveillance area 1.0 - 4.0 metres on each side of the tread to a maximum of 10.5 metres combined tread and surveillance area; understory vegetation and shrubs generally removed from surveillance area when more than 0.75 - 1.8 metres in height; tree branches less than 0.75 – 1.8 metres from the ground also removed from surveillance area

- Narrower sections of trail to contain pullouts allowing users to pass each other or to rest

Tread:

- Area of 1.5 - 2.5 metres depending on usage rates
- Firm and smooth surface, free of cracks, with ruts or bumps no greater than 1.0 cm
- Preferred surface of compacted crushed rock, wood shreds, bark mulch or combinations of these materials
- Alternative surface of concrete, asphalt or similar materials

Grades:

- Wheelchair accessible trails to maintain grades at 0 - 3%, with sustained grade not to exceed 5%
- Wheelchair accessible trails to have a maximum 8% grade for a distance no greater than 4 metres
- Non-wheelchair accessible trails to provide steps when grades exceed 10%
- Zero grade for small, level resting areas at the end of each length of slope and at all turning points on slopes

Handrails:

- Installed when slopes have a sustained grade greater than 5% (these are considered to be ramps)
- Installed for bridges, boardwalks and steps
- Multi-level: 0.9 metres high for walking adults and 0.7 metres high for wheelchairs, scooters and children
- To exist on both sides to accommodate users incapacitated on either their left or right sides
- To extend 45 – 60 cm past the top and bottom of slopes to alert blind users to slopes or steps
- Strong enough to bear the weight of two to three adults (150-200 kg)
- Smooth and free of protrusions, with a narrow, peaked or sloped top-rail to deter sitting or walking on them

Wheelstops:

- Required on all boardwalks and on any sloped surfaces
- 8-15 cm high to provide stopping power but preventing contact with bike pedals
- Designed to prevent trip hazards (ensuring that a person can not get their foot caught between the bottom of the wheelstop rail and the tread surface)

Structures:

- Bridges, boardwalks and steps wide enough for easy passing
- Tread surfaces that provide secure footing under all anticipated conditions
- Boards parallel to the direction of the tread to reduce the number of seams and edges
- Smooth transitions between tread and structures by allowing no more than 1 cm difference between them (except stairs)
- Benches placed after steep sections of trails and at intervals no more than 75 metres apart
- Back rests and high arm rests on benches to assist users in sitting and rising
- 2.0 metre x 2.0 metre areas for wheelchair parking next to benches

Off-road bicycle trails

Designed for:

- Technical, off-road bicycling: a) in response to public demand, and b) on trails where pedestrians and road bikes are discouraged
- Closed circuit riding within designated trails to remove riders from sensitive sites or areas of user conflict

General design and construction specifications:

Design:

- Safety guidelines and etiquette rules posted at all main entrances
- Minimum 0.5 metre surveillance area on each side of the tread, to a maximum 2.0 metres combined tread and surveillance areas (to accommodate bicycle handlebars which are generally 60 cm wide and 75-100 cm above ground, with riders' elbows sometimes extending beyond the handlebars); understory vegetation and shrubs generally removed from surveillance area when more than 0.75 - 1.8 metres in height
- Tread surface may be rough and uneven
- Surface may consist of compacted native soils or woody debris only if they are capable of withstanding the anticipated use
- Sloped sections and areas of less resilient soils must be formally surfaced with one of the recommended trail materials
- Width should be extended by 15 cm on switchbacks, climbing turns and where the side slopes exceed 60%
- Single-track trails should be unit-directional to prevent head-on collisions
- Asphalt shingle material should not be used for tread surfaces because it tends to rip

Features and Structures:

- Pullouts with leaning posts at 75 – 150 metre intervals along single track routes so that riders can pass one another
- Narrow ramps alongside stairs on steep slopes so that riders can walk their bikes up or down the slope

- Modified catch basin grates to prevent catching bicycle tires
- Bicycle racks/lockers at main entrances or resting areas
- Technical challenge features that provide varying levels of difficulty throughout the system and that meet safety standards
- Signage indicating difficulty ratings and optional bypass routes for all challenge features or obstacles
- Handrails where challenge features carry the rider higher than 0.75 metres above the ground
- Smooth surfaces free of protrusions such as nails, bolts, etc.
- Non-skid tread surfaces on all structures
- Tread materials fixed securely in place

A compilation of recommended mountain-bike park technical challenge features should be developed. This appendix should contain photographs and drawings of various features, and stipulate measurements and restrictions for structures. It should be developed by members of the Construction Section with input from the Urban Forestry and Environment Services Section, public volunteers and professional off-road bicyclists.

Table 1 provides challenge feature specifications for intermediate and advanced off-road cyclists. It does not include a beginner's category: trail specifications for General Access and Recreation Tails are identical to those for Nature Trails, and therefore accommodate the low, controlled speeds of both novice and recreational riders.

Attributes	Intermediate	Advanced
Curve Radius	1.8 m	1.2 m
Max. Sustained Grade	10%	15%
Maximum Grade	15-22%	25%
Slope Length	45 – 150 m (slope dependant)	90 m (25% slope)
Tread Width	30 - 60cm (single track)	30 - 45cm (single track)
Clearing Setbacks	30 –60 cm (from tread edge)	30 –60 cm (from tread edge)
Clearing Heights	2.4 m	2.4 m
Obstacles	maximum height 20 cm	maximum height 40 cm

Table1. Off-road Bike Trail Specifications

Equestrian Trails

Designed for:

- Specific user groups
- Horseback riding (in consultation with equestrians) where there is high demand

General design and construction specifications:

- Construction and maintenance to the same standards as General Access and Recreation trails
- Prohibition of horse access to sensitive areas or where user conflicts will occur
- Provision of tethering places
- Minimum 3.0 metre overhead vegetation clearance
- Surface of wood or bark shreds, crushed angular rock or native soils
- Avoidance of switchbacks and sharp turns
- Prohibition of feeds containing seeds to avoid introducing non-native plant species
- Provision of specific areas for browsing or grazing
- Discouragement of browsing or grazing on trail edges

Vehicle Access Pathways

Designed for:

- Limited and specialized uses in natural areas
- Fire access, but can be used for recreational purposes

General design and construction specifications:

- Tread areas 2.5 - 4.0 metres
- Tread area and base compacted to carry heavy loads
- Tread surface of crushed rock, but could be asphalt, cement, etc.
- Vegetation clearance of one meter on each side of the path
- Minimum 3.0 metre overhead vegetation clearance
- Surveillance area of 1.0 - 4.0 metres on each side of the tread to a maximum of 10.5 metres combined tread and surveillance area
- Surveillance area appropriate to trail purposes, type, usage rates, location and potential personal risks
- Understory vegetation and shrubs generally removed from surveillance area when between 0.75 - 1.80 metres in height

Multi-Use Pathways

Multi-use pathways are not suitable for most natural areas due to the intrusiveness of the path. Considerations must include size and type of natural area.

Designed for:

- Large numbers of people
- Multi-purpose use and transportation links within the City
- Areas such as utility right-of-ways, deactivated roadways or land adjacent to transportation routes such as skytrain

Design and construction specifications:

- Minimum 4.0 metres wide with paved surface

Trail Inventory

Currently, trail use is not accurately quantified in Surrey, nor is there a current trail inventory. The gathering of trail inventory information is critical to conducting maintenance management programs that prioritize and record trail work. It is recommended that the City of Surrey eventually identify, map and describe all existing trail networks and pathways within the natural areas of City parks. The trail inventory should be documented and stored electronically in both arcview (spatial database) and maximo (tabular database), which are the City's current applicable asset management database systems. The inventory database should be reviewed annually to ensure accuracy and integrity.

Four types of trail classes should be inventoried first: universal access, general access and recreation, recreation and nature, and service vehicle pathways. This inventory should occur in the following order.

Trails and paths in:

1. Dedicated natural areas
2. Flagship parks
3. Premium parks
4. Standard parks
5. Natural parks such as greenbelts
6. Undeveloped parks

Once this inventory has been completed, a second inventory should be undertaken for nature trails, off road bicycle, multi-use pathways, equestrian trails and unsanctioned trails.

Inventory Gathering Methodologies

The Surrey Parks Division should utilize Global Positioning System (GPS) technology to map and digitally store all spatial information related to trails. This methodology is consistent with other City initiatives related to satellite based mapping technology.

Surrey's existing Geographical Information System (GIS) software will allow for easy integration of collected GPS data and will provide a dynamic inventory and tracking system that could be updated following each inspection or modification of a trail or pathway. Consultation with the Engineering and Information Technology Departments is recommended prior to implementing this system to ensure compliance with existing systems.

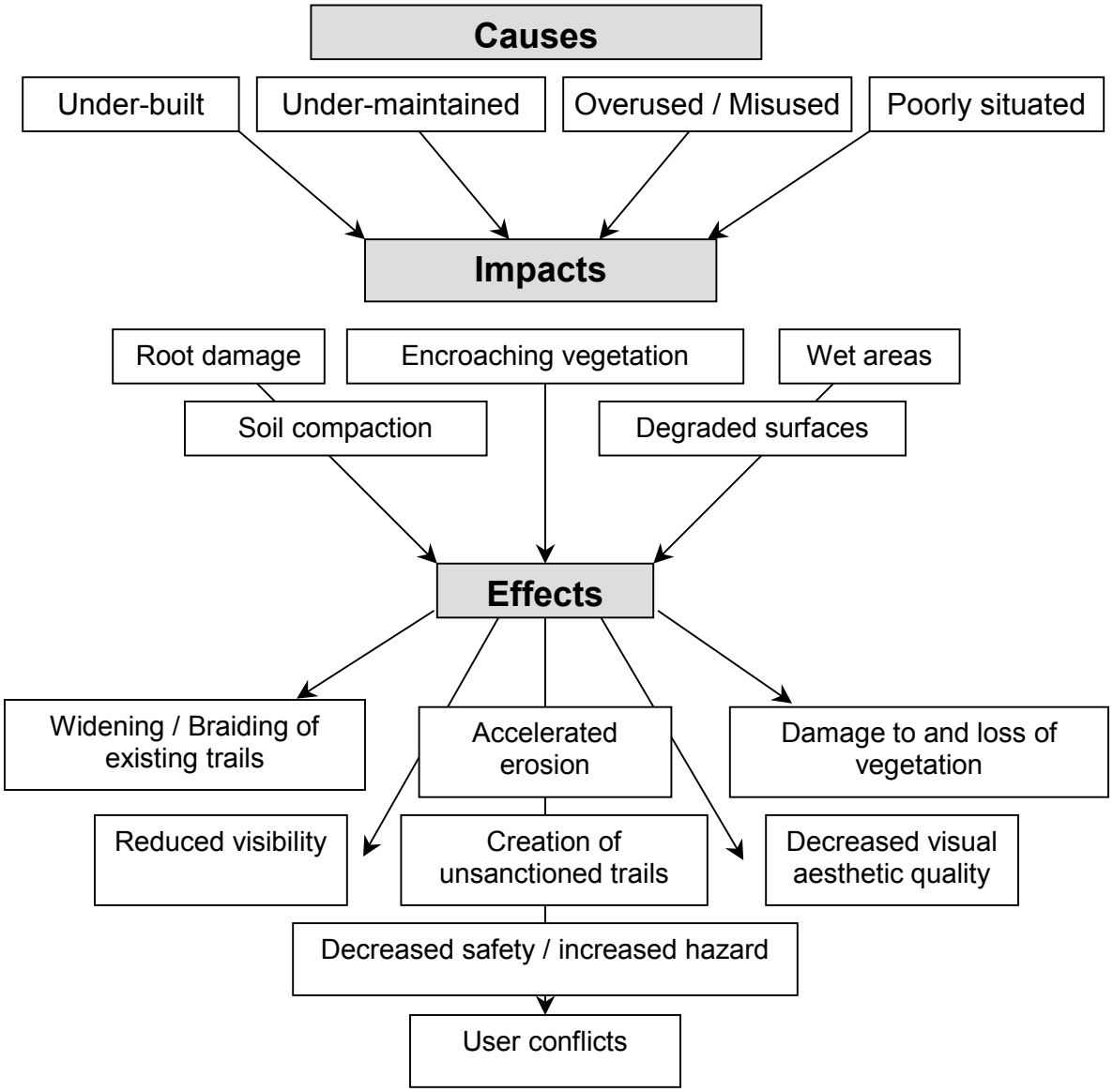
Additional tabular data must also be recorded to properly inventory and describe the attributes of trails. This information should be collected electronically via a data logger that will interface with the existing Maximo software database. (Loggers and software are readily available.)

Part 2: Trail Development: Design, Construction and Maintenance

Development and construction of trails should to be based on clear goals and objectives. Each site must be individually assessed to determine appropriate uses and appropriate development techniques, and impact on the environment, the community and park users.

Common Impacts

Inadequately built, poorly located, overused and under-maintained trails have resulted in a number of negative impacts that degrade Surrey's natural areas. Consequently, these impacts reduce the quality of user experience and can contribute to the creation of hazardous conditions.



General Recommendations

- Develop a standardized trail classification system with design specifications.
- Consult with the public and other City departments before developing trails
- Use trail building techniques that minimize site disruption
- Develop standardized construction techniques that are compatible with site ecology
- Ensure ramps, boardwalks and similar structures are included when designing trails
- Formally adopt and apply stipulated trail development concepts and procedures

The following sections outline a comprehensive planning, design and construction process for trail development as a major initiative to reduce negative impacts and resolve user conflicts.

Trail Development Team

To reflect and address the diversity of trail issues and trail management concerns, it is important to assemble a team of experts with a diverse range of knowledge, skills and experience. The core team should be the group ultimately responsible for and directly involved in the final layout, design, construction and maintenance of trails or trail systems. Team members will participate to varying degrees at different stages. An extended team could consist of individuals from outside agencies who will participate on a consultation basis only.

1. The Core team should consist of qualified representatives from the following:

    a) Surrey Parks, Recreation & Culture Department, Planning, Research and Design Section

    b) Surrey Parks Division Urban Forestry and Environmental Services Section

    c) Surrey Parks Division Development Services Section

    d) Preferred Consultants and Contractors

1. The extended team could consist of qualified representatives from the following:

    a) Surrey Engineering Department

    b) Federal Department of Fisheries and Oceans

    c) BC Ministry of Environment, Lands and Parks

    d) BC Ministry of Forests

    e) Local Urban Forest Advisory Committees and other public special interest groups

    f) International Mountain Biking Association

    g) Colorado Trails and Wildlife Task Force

h) Surrey Parks, Recreation and Culture Department, Marketing, Communications and Development Section

1. The other participants:

a) **Labour Force**: This is a very important and much overlooked group who play a key role in the ultimate quality of trails. Like the Trail Development Team, this group would optimally consist of experienced trail construction personnel with training in ecology, wildlife and fisheries management, arboriculture, hydrology, soil conservation, vegetation management, risk management, road building, construction and visual landscape management. In the absence of a crew with these skills, a qualified, on-site supervisor/monitor should be assigned to the project.

b) **Local Public**: Past experience has shown that it is usually better to include the local public in the concept planning process in order to identify public desires, and hopefully to achieve acceptance early on in the project. A watchful public can, and have, completely shut down trail construction projects in the City due to public misconceptions and a lack of pre-project consultation between all stakeholders.

Team members will perform specific roles in order to:

- Provide trail-related input to aid in high-level parks planning decisions
- Carry out site assessments prior to trail layout and construction
- Plan, design and lay out trail systems at the site level
- Perform or supervise the construction or enhancement of existing and new trails
- Prescribe inspection and maintenance schedules for trail systems

Trail Development Team members should:

- Be familiar with Surrey's policies and procedures, with respect to public risk management
- Have a working knowledge of the City's existing Park system
- Be familiar with the broad goals and objectives of the City's trail and pathway system
- Understand the basics of trail-related initiatives such as the Greenways program
- Be aware of existing municipal, provincial and federal legislation related to trail issues

Be familiar with the following literature:

- Surrey's Natural Areas Access and Recreation Management Strategy
- BC Parks Standard Guidelines (for Trails)

- Parks Canada's Trail Manual (relevant sections)
- Planning Trails with Wildlife in Mind
- Surrey Corporate Report ("Walkway Right of Way Width Standards")
- Lightly on the Land (the SCA trail building and maintenance manual)

Annual training sessions should be organized by senior members of the team and attended by all team members and applicable staff.

Planning and Conceptual Design Stages

This section provides guidance for the planning and design of new trails and pathways. The concepts and procedures within this section should also be applied to Surrey's existing trails and pathways if their purpose has not been adequately designated in the past.

1. Define Trail Purpose

Each trail must be assessed and reviewed for the following:

- Type of activity that will occur, or is planned to occur, on the trail, then classification of trail type (see Surrey Trail Classification System). This assessment will need to consider user ages, approximate numbers of users, etc.
- Consideration of short- and long-term use, and potential implications of each.
- The *Parks, Recreation and Culture Master Plan*, applicable *Official Community Plan* and *Neighbourhood Concept Plans*.
- Any planned trail systems and existing trail systems in the vicinity of the proposed trail system.
- Type of land use designation given to the site, its intended parkland use designation (e.g. developed park, urban natural areas, riparian area, greenway) and management objectives.

2. Conduct Site Reconnaissance

No design work should take place prior to performing a site visit. A reconnaissance visit should be performed to establish the overall lay of the land, the character of the site, and the capacity of the site to fulfill the purpose of the trail. The reconnaissance will also aid in accurately deciphering details in maps and photos.

Site analysis should include a comprehensive overview of the area followed by feature identification and base map creation. For the overview maps and photo assembly, maps and aerial photos from scales of 1:1000 - 1:20, 000 should be used as follows:

- Topographic maps of the site and surrounding areas
- Tree survey maps and arborist reports
- Surrey's Fish stream classification maps (SHIM maps if available)
- Surrey's Environmentally Sensitive Areas Map (ESA map)
- Surrey's Vegetation and Wildlife Habitats Map
- Geological, hydrological, wildlife, soils or archaeological surveys

- Existing, current planimetric maps
- Existing conceptual plans

If any of these primary inventories or surveys has not been undertaken, they should be performed at this time.

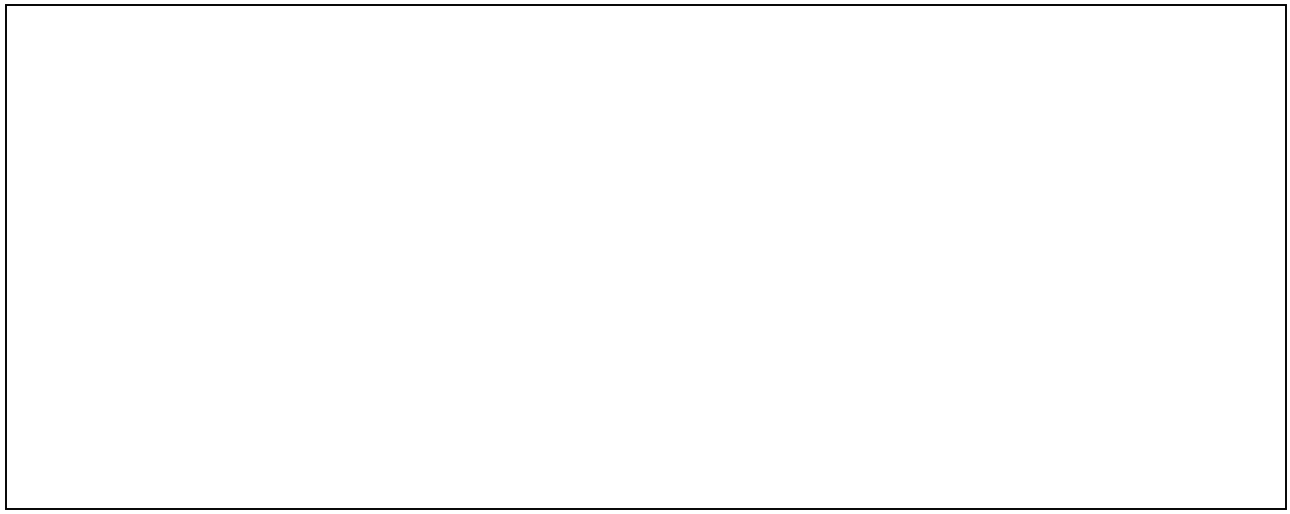
Reconnaissance findings will include these surveys, any other relevant information sources, and personal observations. Based on these findings, all visible significant and constraining environmental, geological and ecological features should be identified and plotted. These features include:

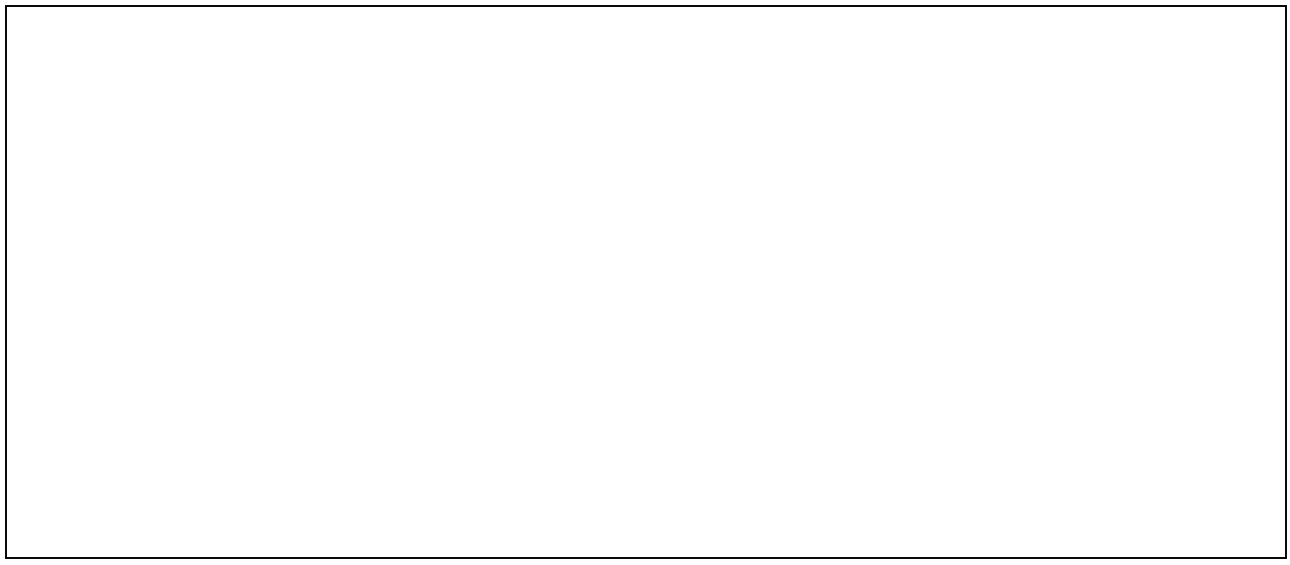
- Legal property boundaries.
- Drainage features and flow patterns—all rivers, lakes, ephemeral and perennial streams and tributaries, ditches, ponds, wetlands, fens, bogs and groundwater.
- Hazardous areas—stands of dead or dying trees, cliffs, slide areas, road or gully crossings.
- Sensitive and interesting species, both terrestrial and aquatic components (see Vegetation and Wildlife Habitats of Surrey Map as a baseline reference).
- Historical or archaeological features.
- Steep or otherwise erosion-prone slopes.
- Vegetation polygons and wildlife corridors (use Vegetation and Wildlife Habitats of Surrey Map as a baseline reference).
- Interesting habitat features, landforms, species and individual organisms—rock bluffs, waterfalls, tolerant wildlife, nurse logs and stumps, large trees, etc.
- Scenic view points.
- Commercially valuable resources.
- Contaminated soils.
- Existing and past disturbances, or site modifications, both natural and human caused.

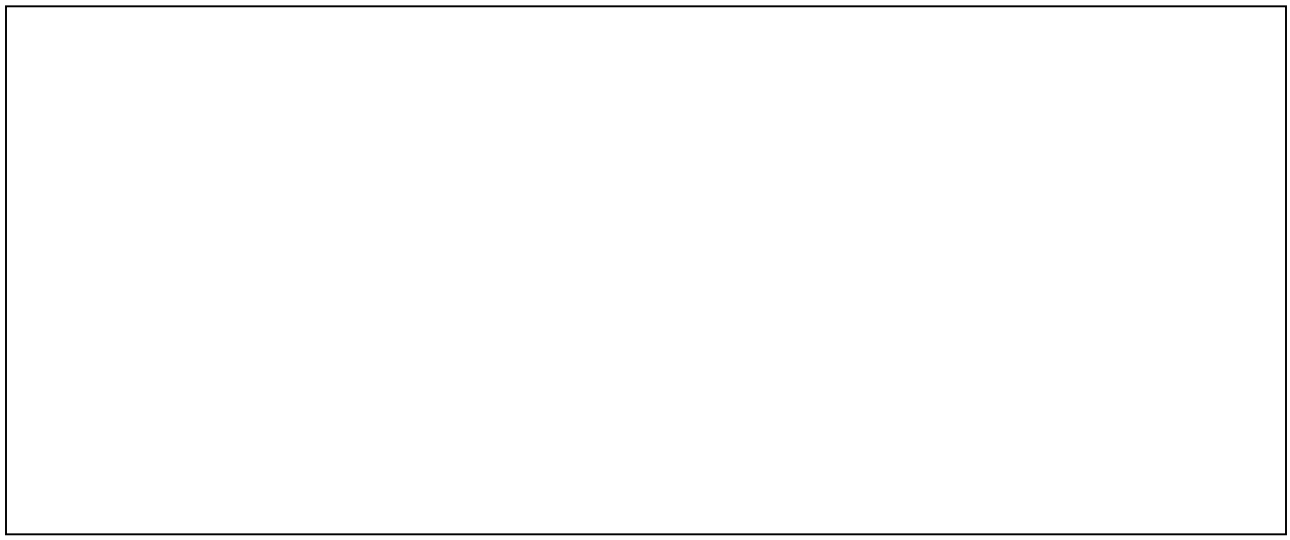
3. Develop a Trail Concept

Potential routes on the base map should identify all relevant features and should be drawn to rough scale as overlays to the area map. Individual legs of the trail should be labeled with approximate azimuth bearings and lengths to aid in ground truthing during the following layout phases.

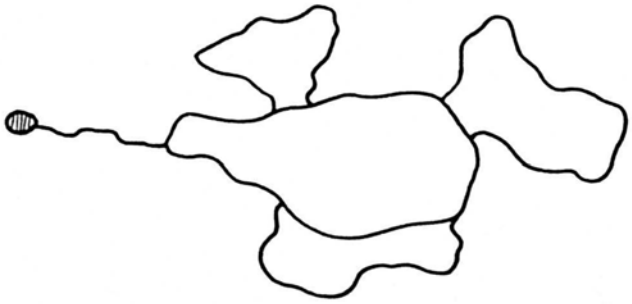
The design constraints of an urban landscape include property boundaries, roads or other developments. These factors limit flexibility of design. Trails can be laid out in a variety of ways to accommodate such constraints and to meet specific objectives. Generally a variation of the stacked loop system is the preferred design for a recreational trail, for it allows users to choose from a variety of trail lengths and return to their point of origin without backtracking. Where direct access from point A to point B is desired, a linear style is preferred. Combinations or variations of these can be employed, see examples below.



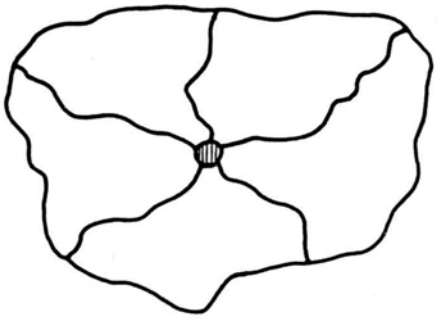




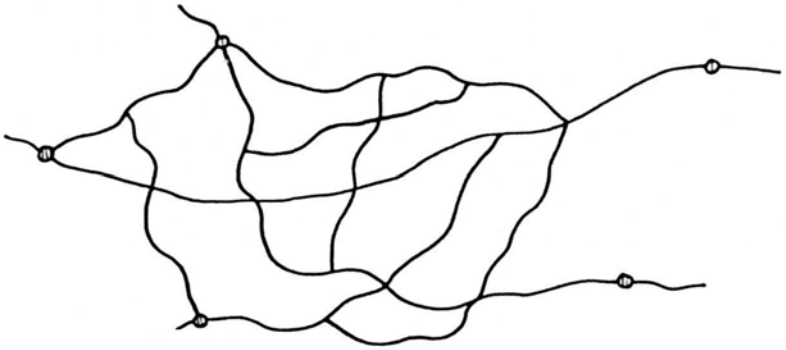
Satellite Loop
A variation of the Stacked loop that allows for greater separation between trails of different use classes or in different environments.



Spoked Wheel
Offers a wide range of travel distances around a central focal point. This is not a widely used style.



Maze
This style offers the greatest degree of user experiences and the most exploration. This style of trail can be very confusing to users and can have heavy impacts on certain areas due to their fragmenting effects. This style of trail is often the result of years of short cutting and informal route creation between existing routes.



4. Conduct a Public Process:

Once the preferred trail purpose, potential routes and design have been identified, a public review and information meeting should be held, which may result in modifications to the trail layout.

Trail Construction

The basic goal of trail construction in natural areas is to provide a durable, relatively safe surface for the trails intended uses, while minimizing the associated impacts on the surrounding environment. The construction phases can begin once all of the previous steps have been completed, and funds have been secured for the project. All construction activities should be performed or supervised by qualified persons such as forest technicians, and in accordance with the following guidelines.

1. Layout Guidelines

c) Restrict the clearing of trees, vegetation or any other site disturbances to an absolute minimum, acting only on vegetation that impedes the visual establishment or subsequent measurement of the trail. All vegetation, wood and soils removed to accommodate the trail can and should be salvaged and utilized in the final stages of trail construction.

d) Consider the trail's zone of influence (tread and surveillance area) when planning (2-10 metres on either side of the trail).

e) Project ahead to the next few legs of the trail and look back along it to assess difficulty, potential hazards and visual aesthetics from all angles.

f) Consider the implications of the construction phase such as type of machinery or work techniques, the machine access and exit paths, and restricted zones.

g) Choose flagging tape and paint that is of a different colour or pattern than any other tape on the site.

2. Construction Guidelines

a) Do not construct trails by simply clearing or trampling vegetation and native soils until a path is worn. These types of trails are known to degrade quickly in wet climates and cause a myriad of problems. Native soils and/or parent materials should be adequately prepared and, when required, capped with engineered materials in order to withstand the intended uses.

b) Avoid clay, organic, or pure sand soils. The type of subgrade required to stabilize a tread surface will be very dependent upon the characteristics of the existing soils. The best surface will be a result of suitable subgrade.

c) Use the appropriate amount and type of base preparation. High use areas, fine or evenly sized particle soils, sloped trails and areas prone to erosion or saturation will increase the need for a coarse subgrade material. Conversely, low use areas, coarse soils and those with good particle size distribution will require less base preparation.

d) Avoid the use of asphalt or concrete to surface trails and paths in forested or treed areas. These surfaces are very smooth and are initially cheaper to maintain but they have distinct disadvantages. They are easily destroyed by tree roots, they can alter surface hydrology, reduce water permeability and increase erosion and heat absorption. They may create leachates and they look and feel unnatural.

e) Match equipment and techniques to the site. Do not tailor the site to accept existing equipment and techniques.

f) Keep first-aid and spill clean-up equipment on hand at all times when building or maintaining trails.

g) Avoid the use of materials that are known to create leachates. These materials include treated lumber, bark mulch, crushed limestone, crushed concrete, asphalt and some types of wood chips.

h) Experiment with new, environmentally safe soil and aggregate pavements and stabilizers as well as various types of geotextiles to provide tread durability and prevent erosion. Consider gradually replacing existing asphalt paved surfaces with non-leaching or permeable surfaces.

i) Favour the use of materials that are indigenous to the site or locality and those which visually blend with the surrounding environment.

j) Incorporate native materials into construction and rehabilitation whenever possible. Utilize logs, rocks, salvaged plants, duff and topsoil.

k) Provide on-site compensation for all habitat values that are compromised by trail construction.

l) Use elevated structures to cross wet areas as opposed to filling and culverting these areas.

m) Provide directional signage at all trail junctions and spurs.

n) Minimize trail widths, especially in more sensitive environments. This not only lessens the direct construction impacts but can also control damage.

o) Restrict stream and channel crossings to an absolute minimum. Consultation with the BC Ministry of Environment Lands and Parks as well as with the Federal Department is advised. All crossings must be constructed within the guidelines outlined in *Access Near Aquatic Areas*.

p) Restrict crossing seasonally wet areas to an absolute minimum. Preferred methods involve completely bypassing the area or completely elevating the trail above the wet area with a boardwalk. If a boardwalk is not possible, geotextiles and geogrids can be employed to create a "floating" trail surface.

Infield Trail Layout

Crew and Equipment Needs

A two-person layout crew is recommended: a staff person of the Parks Urban Forest and Environment Services Section and a staff person of the Parks Development Services Section. The following equipment should be available:

- Machete, Swede saw
- Hip Chain, thread and an Eslon Tape
- Compass and Clinometer
- Field notebook & pencil
- Base map and aerial photos
- Trail layout forms
- Biodegradable spray paint
- Black waterproof felt marker
- Tree tags and hazard evaluation forms
- Hammer and nails
- Camera
- Personal protective equipment as required

Layout Procedures

From the possible trail locations drafted in the office, the crew should begin by walking the site along these approximated routes. The purpose and style of each trail should be applied as necessary criteria while confirming the layout. If an impassable or extremely sensitive area is encountered, one should reconsider building a trail through the area. While walking the proposed routes, the following features, as described on the base map or encountered on the site, should be considered and the path of the trail adjusted accordingly.

Drainage patterns

Assess the microtopography of the site as this will likely be much more detailed than the topographical or hydrological survey maps indicate. If crossing a fish bearing waterway, the Department of Fisheries and Oceans must be consulted. If the trail is to be within 15 metres of the top of a stream bank, the BC Ministry of Environment Lands and Parks must be contacted. Drainage patterns will strongly determine the path of the trail and will influence costs directly. General rules include:

- Stay on high ground and avoid crossing drainates or wet areas whenever possible.
- Do not build within 10 metres of the top of a bank when in riparian areas.
- Utilize raised or floating walkways to cross wet areas as opposed to filling the wet spots with imported materials.
- Design trails and employ drainage features so as to minimize changes to the original site drainage patterns.

Soil types:

All efforts must be made to minimize unnecessary soil compaction, excavation and bare soil exposure.

Soil horizon—note the depth and variability of soil horizons.

Soil type—Visually assess texture, mineral and organic content, live root content, drainage characteristics, erodability and workability. This will help to determine the amount of excavation and imported material required, and the best type of subgrade, armour, drainage features and trail surfacing to use. The best type of soil to build a trail on is a coarse, well-drained, mineral soil of mixed aggregate sizes with limited fine particles. (See Table 2 for sill characteristics and types).

Canopy cover and type—determine the degree and type of forest canopy cover and assess how it will influence such factors as light penetration, visibility understory, vegetation growth rates, rain and wind penetration, soil erosion, temperature and overall scenery from season to season.

Soil Characteristics	Degree of Soil Limitation		
	None to Slight	**Moderate**	**Severe**
Wetness	Well and moderately well drained soils with seasonal water table below 1m.	Moderately well drained to somewhat poorly drained soils. Subject to seepage or ponding. Seasonal water table 30cm.-1m.	Poorly drained and very poorly drained soils. Seasonal water table < 30cm.
Flooding	Not subject to flooding during season of use.	Object to occasional, mild flooding. May flood 1 or 2 times during season of use.	Frequent flooding during season of use.
Slope	0-15%	15-25%	25% +
Surface texture	sandy loam, fine sandy loam, very fine sandy loam, loam	silty loam, silty clay loam, sandy clay loam, clay loam, loamy sand	silty clay, sandy clay, clay, sand, organic soils and those subject to severe blowing
Surface rockiness	Classes 0, 1, &2	Class 3	Classes 4 and 5

Table 2. Soil Characteristics and Limitation

Based on definitions in "The System of Soil Classification for Canada. Publication #1455. Agriculture Canada. 1974 pp. 217-219

- Rate canopy cover periodically, along the length of the trail, with a Canopy Densiometer (moosehorn) to quickly determine the percentage of canopy cover.
- Note whether tree canopy is made up of predominantly deciduous or coniferous trees as this will influence seasonal light levels.
- Note the aspect of the trail sections. Combined with the canopy information, this will determine how much light and wind will penetrate the canopy.

Vegetation types: Assess whether the vegetation will have difficulty regenerating or regenerate too quickly and cause maintenance problems.

- Generally, species associated with early seral stages, deciduous forests and those with a south facing aspect will grow and regenerate much faster than those in later seral stages, coniferous forests or north facing aspects.
- Record species names and approximate relative quantities for use when revegetating after trail construction. (See Vegetation Management Strategy)

Hazards: Identify and avoid potential hazards such as perched rocks or logs, hazardous trees, washouts or sink hole hazards, trip hazards and poisonous plants.

- All hazards that are not avoided will have to be mitigated.
- A qualified person should be utilized to perform tree hazard assessments (See *Tree Hazard Management Strategy*).

Slope steepness: Generally, avoid slopes of greater than 15%. Short, steep sections are acceptable on limited access trails but are not acceptable on universal access trails.

- If steeper slopes are unavoidable, design climbing turns, switchbacks or stairways to traverse the slope.
- Measure slope steepness with a clinometer for quick grade readings.
- Do not build trails on stream banks. If this is unavoidable, the BC Ministry of Environment, Lands and Parks must be consulted prior to any site activities. Refer to Section_____ [do you have this info Greg?]

Habitat types: Avoid habitat fragmentation and edge creation.

- Identify and stratify habitat polygons on the site maps.
- Try to keep to natural edges and previously disturbed areas when possible.
- Do not bisect undisturbed, sensitive habitats such as riparian areas or closed conifer stands.

Habitat elements: Avoid the destruction of individual habitat elements such as coarse woody debris, den sites, nest sites, food sources and significant wildlife trees. These elements should be avoided, relocated, or, if they are compromised, compensated for.

Root zones of trees and other sensitive vegetation: Avoid laying the trail too closely to trees that are to be retained. Trail edges should be laid out no closer to trees than the distances specified in Table 3. These are minimum distances and should be increased whenever possible.

Tree Diameter	**Distance for Base of Trunk**	
At 1 metre above point of germination	*Minimum*	*Preferred*
15 cm	1.2 m	>1.5 m
22.5 cm	1.2 m	>1.5 m
30 cm	1.2 m	>1.8 m
37.5 cm	1.5 m	>2.1 m
45 cm	1.8 m	>2.4 m
52.5 cm	2.1 m	>2.7 m

Table 3. Root Zone Specifications
From: Root Protection and Pruning (City of Vancouver)

Interpretive features: Features of interest should be included along the route unless the close proximity of a trail and its users poses a threat to the integrity of the feature. Features should be erected close enough to the trail to provide easy viewing but should not be so close as to invite the destruction of the feature through casual exploring by users. Twice an arm's length from the trail edge is a good rule of thumb. Trails should be laid out to lead users away from sensitive or rare features. Vegetative screening and physical barriers such as logs or rock can be employed to further protect these features.

Visual appeal: The overall visual appeal is subjective. Use common sense to choose the "best" route for visual effect. Consider the users' feeling of safety. Incorporate viewpoints and consider seasonal changes in scenery.

Preliminary Trail layout

Choose the Trail Head

The trail head is the formal entrance to the trail. In cases where the trail being laid out is an extension of an existing system, the Trail Head is simply the term used to describe a reference starting point for the new section.

Choose the trail head based upon other access features such as parking, sidewalks and existing, linking trails. If this head is the starting point for an entire trail system, not just a spur or section of a system, allow for the creation of a formal trail head area with items such as gates, baffles, and kiosks, or simply allow users to temporarily congregate or to easily pass one another upon entering or exiting the trail.

Establish the Trail Legs

Trails are divided into legs just as streams and rivers are divided into reaches for the purpose of subdividing a linear system into smaller, somewhat homogeneous management units. A new leg should start each time there is a change in direction, slope, or surrounding vegetation type. New legs should also be established when there will be a change in the materials used to build the trail or when the tread or ROW width changes.

1. From the trail head, begin choosing the actual route of the trail. This should be a fairly time intensive process as all of the concerns above must be addressed during this phase.

2. Use flagging tape, tied to brush, branches or stakes, to identify the rough route. Be consistent with the placement of the flagging tape, i.e. centerline of trail. Place only enough pieces so that they are visible from one another.

3. Be sure to allow for the width of the entire trail right-of-way, not just the tread surface. Also consider the trail's zone of influence, which can extend for several meters past the edge of the ROW.

4. Scout ahead at least 3-4 legs and walk back along each leg while roughing it out to ensure that it is accessible and visually pleasing from all potential travel directions.

5. Review the site maps and aerial photos regularly to keep track of where the trail is actually being laid in relation to existing site features.

6. Continue this process until the entire trail system or section is roughly laid in place.

7. During the preliminary route planning phases, make notes on key features, necessary structures or any other relevant factors which will influence the construction phases.

*If the trail is laid out exactly according to the draft plans, it has likely not been adequately fitted to the site.

Final Layout

1. Return to the trail head to begin the final layout phase.

2. Fine tune the layout of each trail leg (section) by adjusting the position of the flagging tape.

3. Finalize each leg's position by planting flagged pigtails or stakes, or blazing with biodegradable spray paint along the centerline of the trail. A measuring device should be utilized to determine the position of the trail centerline within +or- 30 cm.

4. Mark the flagging tape with a black felt pen to indicate placement of structures or specific trail features.

5. Continue along the trail until all legs are finalized. Return to the trail head.

Mapping

A pre-construction trail layout map is essential to estimate costs, guide the construction phases and achieve a broad overview of how the trail fits into the landscape.

1. Starting at the trail head, begin mapping the entire system using the chain and compass method or a GPS and a rangefinder.

2. Measure all distances and direction bearings along the centerline of the trail.

3. Measure distances with a hip chain or an Eslon tape, in meters, accurate to the nearest decimeter.

4. Take an azimuth bearing, accurate to the nearest degree, always heading from the trail head, into the system. Record these figures and draw a corresponding sketch map to compliment and clarify them. Note all other relevant features, constraining factors and necessary structures on this same map.

5. If a GPS is being used, azimuth bearings are not necessary but ground measured distances are needed because the GPS will give horizontal distances, not actual ground slope distances.

6. Measure slope angles, with a clinometer, to the nearest percent. Measure slope angles up the slope as per its relative aspect as well as along the intended route of the trail. Record these slope measurements on the map.

7. Map all areas that require structures, drainage features or other specific features.

Cost and Material Estimates

Once the layout and mapping phases are complete, material needs and costs can be more accurately estimated.

Based on collected notes, create a material list and cost estimate for each leg of the trail. This will allow for subdividing the construction process into phases if costs inhibit the completion of the entire system in a single phase.

1. When calculating total costs, use distance measurements, subgrade and tread material types and depths, drainage features, structures, equipment and operator costs, crew costs, administration and monitoring costs.

2. When calculating cots, include factors such as hazard abatement, ROW clearing and grubbing, replanting, slope stabilization requirements, and permits, etc.

3. Estimate maintenance costs for future budget planning.

4. Consider the use of locally available, natural materials such as plants, timber, rock, and soil to lower construction and rehabilitation costs.

The final planning phase prior to the construction phases involves the following procedure. Before beginning to build trails, consideration must be given to all details pertaining to materials, structures and features, preferred access routes, no-go zones, material storage areas, turnarounds and emergency evacuation routes. As crews and equipment enter and exit the area, every effort must be made to restrict site disturbance.

Trail Building Procedures

Equipment and Machinery

Trails in natural areas must be built carefully, always minimizing disturbances to the surrounding environment. Machinery must be friendly to the environment in which it will be utilized. Whenever it is inappropriate to use machinery, manual labour must be employed in all areas of trail planning, layout, construction and maintenance. Specifically, where tread width is less than 1.0 metre, no machinery should be used, and a manual system should be employed.

Soil compaction and damage to vegetation through physical contact are the primary concerns associated with using machinery in natural areas. Soil suffers the greatest amount of compaction on the first pass over, especially in wet conditions.

The types of equipment and methods used should be determined by:

- The width of the tread area
- The characteristics of the soil
- The drainage patterns of the site
- The distance of trail that needs to be traveled, or the amount of work that needs to be performed.

If machinery is to be used in natural areas, efforts must be made to mitigate the potentially negative effects of this equipment. Pressure dispersion pads, tree bark and root protection devices, and materials and environmentally safe operating fluids can all help reduce negative impacts. Currently, these features are not used as often as they should be. When choosing machinery for use in trail systems, the following guidelines should be adhered to:

- Machinery width must not exceed the minimum shoulder width.
- Machinery heights should not exceed trail vegetation clearance heights.
- Flotation rates for machinery and trailers must always be as high as possible (low ground pressure) to avoid compaction of base, subgrade or tread materials.
- Rubber or plastic track machines are generally preferred but low pressure, high flotation rubber tires are also acceptable. Pressures exerted on the ground should not exceed 15 p.s.i. and should optimally be between 1-10 p.s.i.
- If floatation rates cannot be met, pressure dispersion pads must be employed at all times.

The following is a reference list of suitable machinery for use in environmentally sensitive areas and in confined spaces. This is only a partial list; many other varieties of comparable machinery are also available.

Machinery for areas with 1.0 - 1.75 metre tread width	Machinery for areas with 1.75 - 2.5 metre tread width
Kubota KC-50 track dumper	Any of the previously listed machines
Kubota XC-41-2 mini excavator	John Deere Gator
Cat 301.5 mini hydraulic excavator	Cat 216 Skid-steer loader
John Deere 4100 narrow compact utility tractor	Polaris Ranger 6x6
Polaris Big Boss 6x6 ATV (with tracks if possible)	Ingersoll-Rand Bobcat
Yamaha Grizzly 4x4 ATV	Mini excavator (match track width to trail tread width)

Pick-up trucks should not be driven on trails unless the trails have been specifically built to withstand the ground pressures associated with standard tires and truck weights (minimum 15 cm deep compacted road mulch or otherwise stabilized hard surface), and where the tread width is at least 30 cm wider than the width of the vehicle's wheels. Trucks or other heavy, wide vehicles will cause ruts to form in the trail's surface and may cause the edges to fail and erode.

In addition to machinery, crews will also utilize a number of hand held tools that risk little or no damage to the site. Basic trail construction and maintenance tools include the following

Clearing Tools	Grubbing Tools	Timber Tools	Material Transport
Loppers	Pulaski	Chainsaw	Wheel barrow
Machete	Mattock	Hand saw	Freighter pack
Brush saw (Swede)	McLeod	Hand axe	Ratchet winch (cumalong)
Pole saw	Shovel (spade)	Auger	Grip hoist (turfer jack)
Leaf blower	Pick-axe	Drawknife	Block and Tackle
Chainsaw	Rock bar	Log carrier	Power winch
Line trimmer	Grub hoe	Peavy	Wire and fibre ropes
		Wedges	
		Chisels	

Right of Way Clearing (see Figure 3)

Clearing activities must be performed or supervised by personnel who can recognize plant species, and who understand their growth habits, the maintenance implications, and the ecological and local significance:

- Harvest all salvageable plant materials from the tread and shoulder areas and store them on-site, according to standard plant salvage practices.
- Remove those plants that are in the setback or surveillance area only if they will directly impede the construction of the trail or if they are a fast growing, intrusive species.
- Employ tree bole and root protection measures at this time. (see figures___ and ___)
- Remove all remaining vegetation, by non-chemical means, from the trail's tread and shoulder areas. To expedite the process, all materials to be salvaged should have been selectively harvested first by hand; then, if appropriate for the site, a mowing or grubbing machine can be used to clear remaining vegetation. Remove shrub roots from the proposed tread area. (not tree roots)
- Prune all tree branches back to the specified clearance widths and heights. Do not prune terminal leaders on trees adjacent to the trail as this promotes lateral growth. All tree pruning should be performed by or under the supervision of a certified arborist.
- Spread, chip and disperse or remove all small organic debris from the site.

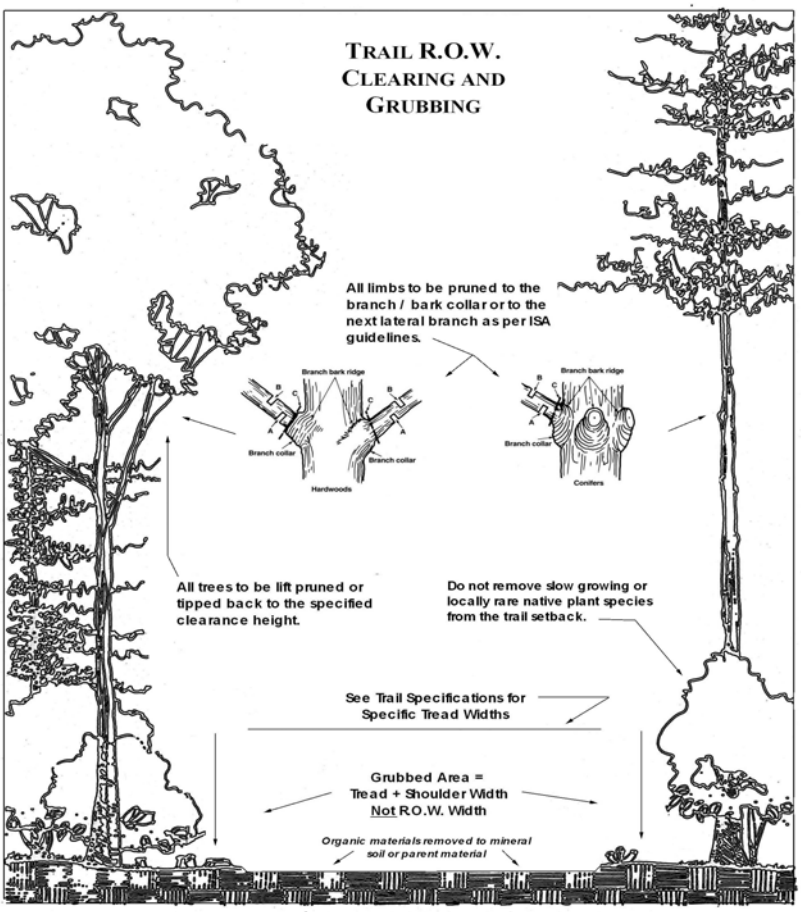


Figure 3. Trail Right of Way Clearing and Grubbing

Hazard Abatement

All hazardous trees and other hazards, such as perched rocks or logs, must be actively searched for and either mitigated or avoided altogether.

a) All hazard tree inspections must be carried out by a qualified person.

b) All hazard abatement work should be performed in such a manner as to maximize the resulting visual aesthetics (Refer to *Coarse Woody Debris Management Plan*).

c) Whenever practical, debris from hazard tree abatement work should be utilized as habitat enhancement features or as trail building material. If the timber is usable, hazard tree abatement work should maximize the potential for log lengths and fall near to the trail.

d) All chipped, indigenous materials should be retained for use as erosion control and soil amendment material.

Grubbing and Base Preparation

Existing native soil trails throughout the City are degrading on an ongoing basis and tend to become unusable or unsightly if left unmaintained. Although such trail systems provide a somewhat natural feel and are cheap to construct, the associated problems far outweigh the advantages (See Table 2. Soil Characteristics and Limitations). For these reasons it is recommended that trails in Surrey's natural areas should not be constructed with native soils exclusively.

a) Trail sections that will be traversed via structures (e.g. under suspended stairways or boardwalks) should not be grubbed.

b) The organic (LFH) layers of the existing soil should be scarified from the surface until mineral soil or parent material is reached.

c) The trail subgrade should optimally rest on mineral soil or parent material in all sections. If this is not possible, due to extremely deep organic layers, the litter and humus layers should be removed. The remaining organic layers should then be contoured and covered with water permeable geotextile to prevent the subgrade coarse materials from mixing with, or sinking into, the organic layers. Subgrade materials and tread can be applied as per specifications.

d) If soils are too unstable or wet, avoid the area or construct an elevated crossing.

e) All organic mulch and soil that is removed from the R.O.W. should be stockpiled and stored for future use.

f) Where only very small amounts of organics are removed, it is acceptable to side cast the materials to the downhill side of the trail, being sure to broadcast it evenly over a large area as opposed to creating berms or piles.

g) All roots, both exposed and subsurface, must be treated with care and should be pruned only when no other options are available. Small diameter roots should be pruned cleanly to the trail edge. Larger, structural roots should not be cut.

h) If tree roots are damaged during trail construction, the tree should be assessed by a certified arborist and monitored regularly if it is retained.

i) Material should not be placed directly against the root collar or tree trunk.

j) Measures to protect roots should be applied, especially during construction and maintenance activities, when machinery can damage trees or compact soils. Protective bark coverings and ground pressure dispersal measures should be employed to lessen soil compaction and physical root damage. If tree roots cannot be avoided, they should be protected from soil compaction or direct physical damage with one of the following devices:

- Small boardwalk or land bridge structures (preferred method)
- Natural fibre mats
- Half-pipe sections and clear crush or drain rock packing
- Sand or rounded gravel (non-compactable medium)
- Rip-rap tread
- Structural Geogrid and Geotextiles
- Corduroy tread
- Base materials should be contoured and compacted until stable and able to support the subgrade without allowing it to mix freely with base materials. Drainage ditches and catch ponds should be roughed out at this stage.

Base Stabilization and Soil Armouring Materials:

These measures should be applied to unstable or wet soils to provide a footing base for the subgrade and/or tread. Placement of imported materials into wet areas must be minimized and must not adversely affect local site conditions through alterations in hydrology. Guidelines are as follows:

For trail base stabilization use non-degradable, synthetic products.

For slope and soil stabilization, use natural, biodegradable products for temporary protection until vegetation can become established.

a) Rip-rap: 30 cm or less in diameter. Use as a subgrade base in wet or unstructured mediums, to allow passage of water beneath the subgrade, and to armour trail banks. Install by hand.

b) Fabricated Geocells: for wet or unstable areas where elevated crossings are not necessary.

c) Polyester or Polypropolene Geogrids: to increase weight bearing capacity of subgrade materials or for trail bank stabilization.

d) Woven or Nonwoven, needle punched Geotextiles: to separate or contain materials of different physical characteristics or to armour soils (e.g. separate subgrade from organic base soils).

e) Coco-fibre mats: to temporarily control trail bank erosion.

f) Wooden Corduroy (short lifespan): temporary base material for wet areas. Cap with rock mulch.

g) Subgrade materials should be applied between 50-150 mm deep, compacted and graded to specification e.g., crowned or outsloped 3%.

h) Pit-run: cheapest but may need to be screened for largest pieces. Use when large amounts of subgrade materials are required or when costs are prohibitive.

i) 3/4" to 3" minus road mulch: general purpose subgrade.

- Once applied it should be tamped or rolled to a suitable density.
- The subgrade may be capped (e.g. crusher dust, crushed rock, wood or bark mulch or a combination of these materials), or may be left uncapped if all objectives are met.

Armouring and Drainage Features

Closely following the grubbing and base preparation phase, all armouring, erosion control and subgrade drainage features should be installed. These features should be constructed or placed by hand according to the following specifications.

Drainage features

The function of drainage features is to minimize the disruptions to the site's hydrology while also minimizing the degrading effects that moving or standing water can have on the trail. Standard features include the following:

- Drainage dips
- Cross ditches and waterbars
- Swales and ditches
- Log or rock culverts
- French drains
- Pipe culverts

Examples of specifications for commonly used drainage features are as follows:

Crowns and Cross Slopes: All trail surfaces should be crowned or cross sloped by 2-3%. And then compacted to a stable density. This alone will reduce the need for other drainage features. Crowns can be used where the trail is on level ground or where ditches are present on both sides of the trail.

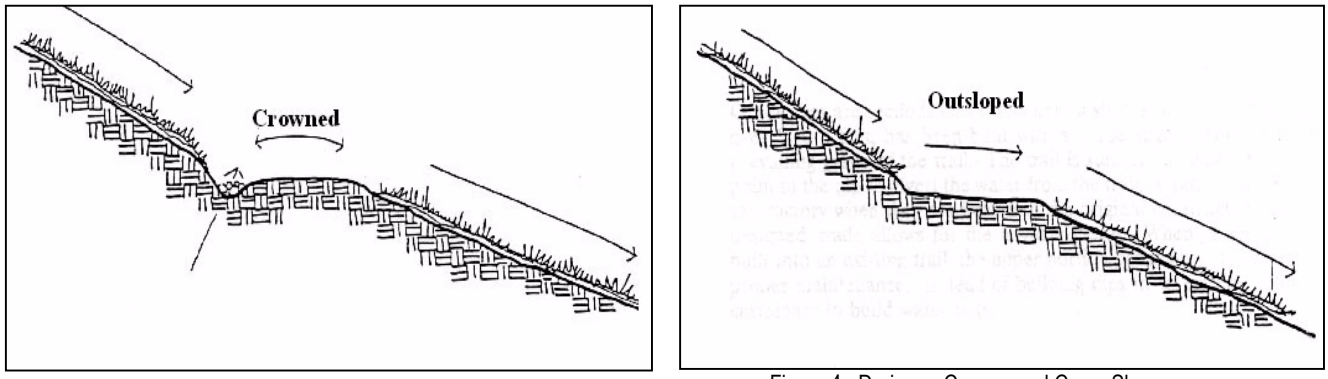


Figure 4. Drainage Crowns and Cross Slopes

Cross slopes should shed water to the outside of a slope (fill bank) except where the inside of the slope (cut bank) is ditched.

Drainage Dips: Drainage dips should be incorporated into the tread during the initial base preparation by creating sections of opposing grades.

Cross Drains: Cross drains intercept water on slopes and shed it to the outside of the trail. These can be built from logs, timbers or rock with many variations. A French-drain style cross ditch is the preferred method as it lies flush with the trail tread and provides no obstructions. All exposed wood should be covered with a suitable tread surface.

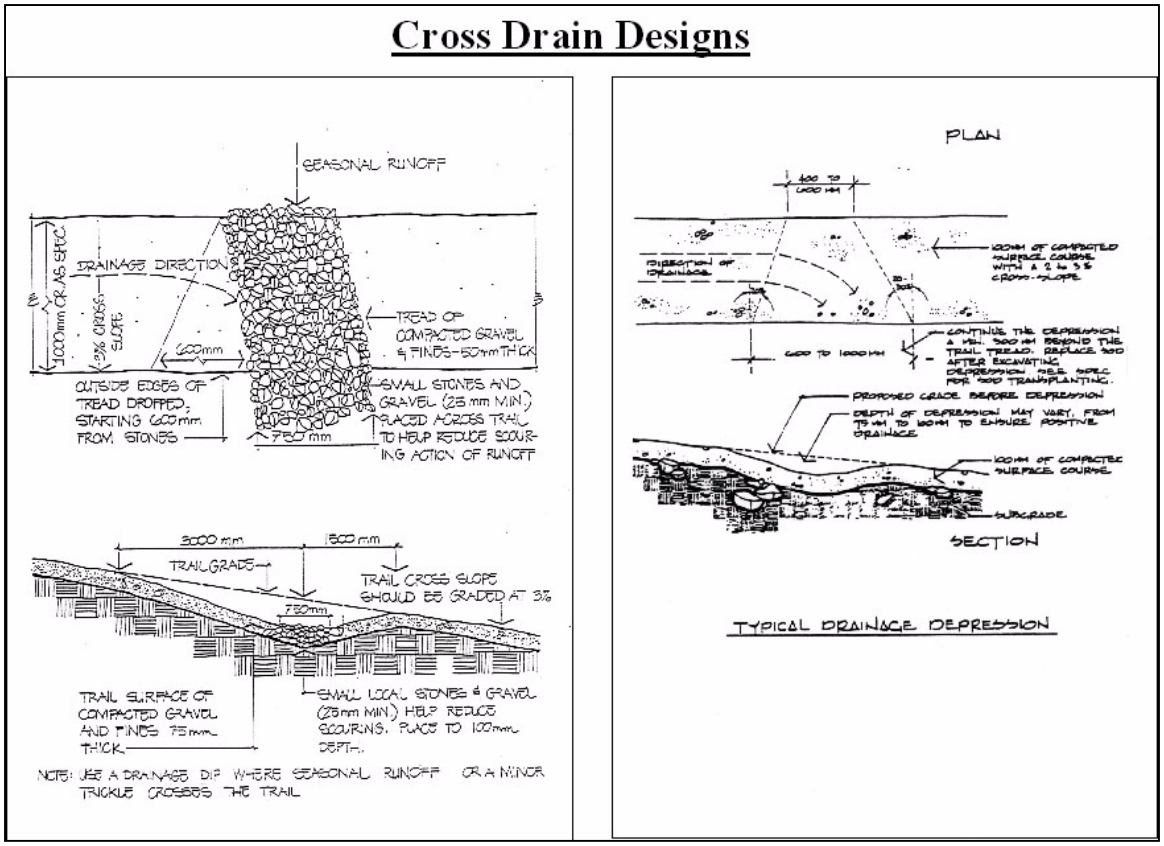


Figure 5. Cross Drain Designs

Material Type	Grade in Percentages						
	2	4	6	8	10	12	15
Loam	100m	50m	30m	25m	15m	-	-
Sandy clay	150m	100m	75m	50m	30m	15m	-
Clay	-	150m	100m	75m	50m	30m	25m
Gravel or rounded rock	-	-	250m	150m	100m	75m	50m
Shale or angular rock	-	-	275m	200m	125m	100m	75m

Table 4. Recommended Frequency of Cross Drains

Tread Surface

To create tread surfaces the following procedure should be followed:

- Premix composite tread materials in the loading area.
- Work backward, along the established subgrade to avoid creating uneven compaction throughout the tread surface through repeated heavy traffic.
- Lay and compact tread materials according to the following specifications.

Tread surface materials provide a relatively smooth, erosion resistant surface. They may be used to cap a subgrade material or they may be placed directly on suitable native soils. If a surfacing of greater than 75 mm is required, use a base of larger crushed stone:

3/16"-1/2" Crusher or Rock Dust: These may be used on all classes of trails (mixed with bark or wood mulch for colour or softer texture). Adding clay to crushed gravel can create a very durable surface that resists spreading better than gravel alone. Apply from 25- to 50 mm deep on average. Grade and compact to a crowned or sloped surface as specified.

Wood and Bark Shreds: Should only be used on nature trails or as a "cap" to an aggregate surface. Cedar shreds or chips should be avoided due to their tendency to leach toxins, the use of hemlock, spruce, pine or fir is preferred. Shreds are better than chips because the shreds weave together.

Wood and Bark Chips:

- Should only be used on nature trails, as a soil covering on trail banks and to close trails
- Must not be applied any deeper than 75 mm.
- Should not be used on slopes as they can become slippery and unstable.
- Should be made on site from native materials and must be small 2 cm in diameter and relatively flat, no more than 2 mm thick.

The following materials should <u>not</u> be used in Surrey's trail systems:

- Crushed limestone
- Red cedar mulch
- Crushed asphalt
- Crushed concrete

Trail Edge Rehabilitation

Place salvaged coarse woody debris and rock strategically along the trail edges to enhance visuals for erosion control and to deter shortcutting.

Re-establish salvaged native plant stock, and establish imported native plant stock to provide visual enhancement, screening, erosion control, and habitat and to deter shortcutting.

- Match species to those that exist on the site and match the existing seral stage.
- When considering how close to the trail edge to re-plant, consider the growth rates and habits of the species and how that relates to the maintenance of the trail.
- Consider relocating high maintenance species further from the edge if feasible.

Place salvaged topsoil in degraded or depleted areas. Attempt to match the depth and compaction of the surrounding native soils.

Place salvaged litter over exposed topsoil. Attempt to match the depth and compaction of the surrounding native litter layers.

Structures and Signs

Install all structures and signs as specified for the trail system.

Final Inspection

Perform a final hazard inspection as per the recommended trail inspection forms. The next inspection will be a minimum of six months from this point.

Perform a general inspection of the trail's overall construction including all structures. Ensure that all trail construction has adhered to the intended specifications and that these specifications accommodate the site's sensitivity level.

Final Inventory and Mapping

Perform an as-built inventory of the completed trail system as per the recommended trail inventory methods. Collect and enter mapping data as recommended.

Trail Operation and Maintenance

Trail systems are the main access for the public to enjoy natural areas and should be operated and maintained in ways that are least disruptive to site ecology, while providing safe and enjoyable experiences for park users.

General Recommendations

- Annual work plans for natural areas should include inspection, maintenance and renovation of trails as a primary activity
- Trail inspection, maintenance and renovation priorities should consider the amount of trail use as well as the environmental sensitivity of the site
- A consistent signage program should be developed for natural area parks

Renovations and Upgrades

Many of Surrey's existing trails need upgrading. These trails are often constructed from native soils and have not been formally surfaced or otherwise engineered. Through repeated use and lack of maintenance, they are subject to excessive compaction, erosion, flooding and expansion. Such effects tend to increase negative ecological impacts while lessening the appeal, comfort and safety of the trail.

Trails that are selected for renovations, upgrades or enhancements should be prioritized according to designated trail use and the environmental sensitivity of the site. As a general guideline, the following site priority order is recommended:

- Riparian areas
- Dedicated Urban Forests
- Parks

Consideration must also be given to the following factors:

- Public demand
- Public safety and security
- Current and predicted future trail associated environmental impacts
- Amount and type of use
- Current degree of trail degradation
- Estimated costs and overall benefits of upgrades

Trail maintenance and repair should be scheduled on a priority basis, and within allowable resources.

- Generally, trail conditions or hazards that could give rise to trail user injury from a 'trip fall' should be scheduled for correction first.
- Conditions that could give rise to difficult use of the trail should be scheduled for correction second.
- It may be practical to schedule lower priority work with higher priority work, along the same trail, at the same time.
- Imminent hazards that could cause considerable bodily harm should be corrected as soon as resources allow. Trail closures may be necessary.
- Trail conditions that have deteriorated to the point where considerable financial resources are required should be scheduled for renovation utilizing capital works or sundry renovation funding that currently resides with the Development Services Section, Parks Division. Work on a trail or trail system in excess of $1,000 should be referred to Development Services for capital or renovation funding. If the renovation work will not be completed within a reasonable time, or the trail condition warrants, the trail inspector should erect a sign warning trail users of the condition of the trail.
- The work order request, as generated by the trail inspector, will contain estimates for materials, equipment, supplies, labour and total costs associated with the work.

Trail Inspections

To fully realize the intended values, trails must be regularly inspected and maintained. The City also has a legal duty of care to ensure that any potential risks to public safety are identified and abated.

The objectives of the trail inspection are to assess the tread surface, vegetation clearance and surveillance area conditions of the trail. The inspection will result in the creation of a maintenance, repair or renovation work order request to provide for:

- Management planning and work execution within budgetary limits.
- A prioritized schedule of maintenance, repair and renovation work.
- Coordinated trail maintenance, repair and renovation work.

Trail Inspection Schedules

Because trails have yet to be in inventoried, frequency standards for trail inspections for City park trails located in natural areas have yet to be determined and the time to conduct an inspection is unknown. Moreover, there are no historical budget amounts allocated to

conduct the work; nor are there any known industry trail inspection frequency standards as recommended by a governing authority or commonly practiced by similar agencies.

The following trail inspection frequency is based on the expected usage rates of the various trail types in the City hierarchy of classified parks (see Trail Classification system).

Trail inspections should be conducted annually for:

- All universal access/barrier free trails, general access and recreation trails, recreation nature trails, and pathways designated off road bicycle trails (e.g. South Surrey Athletic Park Mountain Bike Park)
- All designated trails in Urban Forest Parks (Sunnyside Acres, Green Timbers, Fleetwood)

Trail inspections for nature trails and equestrian trials should be conducted as funding permits, or by demand service request to eliminate a risk or liability. The following guidelines should be applied when conducting trail inspection.

Tread Surface Condition Evaluation

The highest priority for repair and maintenance evaluation will consider surface irregularities and hazards that could result in injury from a 'trip fall' to the trail user, such as:

- Rises and falls of greater than 1"
- Inappropriate surface materials that give rise to abnormally slippery conditions
- Unexpected sharp grade changes.

A lower priority for repair and maintenance evaluation will consider surface irregularities that could result in difficult use of the trail, such as:

- Ponding, puddling, standing water
- Flowing or channeling water
- Deteriorated surface that may be uneven, rutted or dispersed.

Vegetation Setbacks Evaluation

- Assessed according to vegetation clearance standards in the proposed Trail Classification
- Assessed for overhead hazards e.g., "widow makers", broken branches or trees etc.

Surveillance Areas Evaluation

- These areas should be assessed according to surveillance standards in the proposed Trail Classification.

When conducting trail inspections, an inspector may conduct minor trail maintenance or repair if warranted. The decision to do this is based on the amount of time needed to complete the task, and available equipment and materials required.

Trail inspections do not include the visual or detailed assessment of tree hazards but do include site assessment for general tree or forest condition.

Trail Use Monitoring

A trail-use monitoring program should be implemented to determine trail conflict areas, and to prioritize closure, upgrade, inspection, and maintenance programs.

Monitoring Options

One option is a manual system. The most comprehensive method of trail use data collection is to utilize staff members or volunteers to observe and record the user rates and types on site over a predetermined time period. This system allows for the most complete data; additional information can be obtained through user interviews and general observations.

A second option is to employ volunteer systems, where users fill out short questionnaires and leave them in a deposit box. These provide user input but do not provide complete statistical information. Because volunteer participation varies, a separate counting system must be employed to obtain accurate user numbers.

A third option is an electronic system. A variety of electronic monitoring devices are available. The most comprehensive of these would include a camera to obtain photographic descriptions of users.

As a fourth option, if only user numbers are required, a counter device should be employed. Infrared beam systems are effective, easy to set up and hide, and less intrusive than pressure devices or turnstiles.

Trail Closures

As with prioritizing trails for upgrades and enhancements, these undesirable trails should be further prioritized according to how they impact the broader landscape. Existing trails and spurs or shortcuts should be deactivated according to:

- Public demand and safety
- Approved trail system plans
- Current and predicted environmental and ecological impacts
- Associated security risks
- Rate of trail use and associated potential for expansion
- Estimated costs of deactivation and rehabilitation

Procedures

Trail closure procedures include the following:

1. **Identify and prioritize the trails that are to be deactivated.**
2. **Perform a hazard tree assessment in the areas surrounding the trail's entrance points.**
    - Abate any identified tree hazards and utilize the debris to physically block access to the trail.
    - Leave debris pieces as long as possible. Attempt to create wide barriers at the entrance points to increase impassability.

- Use only debris that is larger than 8 cm in diameter. Limited amounts of small debris can be used, but it should be laid flat on the ground to avoid creating fire hazards.
- Attempt to partially suspend larger logs at chest level to further deter access. Ensure these are properly secured.
- Eventually place these barriers, intermittently, along the full length of the trail.

3. If large rock is available, and can be placed without damage to the site, use it to further block the trail.

4. Revegetate the trail's entire tread area.

- Selectively salvage plant materials from the site and relocate them to the trail.
- Harvest plants only from areas that are stable and can easily recover from the loss of a few specimens.
- Till and/or amend the soil in the planting hole if it is compacted or otherwise depleted.
- Plant native plants from nursery stock to complete the revegetation phase.
- Match these species to the native species that are present on the site.
- Favour those species that establish themselves quickly and regenerate readily.

5. If existing tree roots have been compromised through soil compaction, the soil should be aerated and amended with a mulch layer. The tree should be assessed for any hazards and noted in the City's tree database as having been impacted.

6. Apply topsoil and mulch layers to the tread area. Harvest this from surplus areas on the site or import it from clean, stored stock.

7. Place signs at all entrance points to the deactivated trail. These signs should state the reasons for the closure, as well as the penalties associated with illegally reopening it.

8. Perform inspections every few weeks, to assess the effectiveness of the deactivation efforts and to prescribe maintenance if there are signs of the trail being reopened. This should continue until the deactivation has become effective and the trail is no longer used.

- For trails that are repeatedly reopened, consider recruiting local volunteers to perform casual patrols and educate those who are found to be reopening trails.
- If these efforts fail or are not feasible, consider the use of an undesirable but inert organic substance such as manure to further deter reopening of the trail.

Trail Safety and Security

Natural area trails offer secluded environments for the public to enjoy; unfortunately, they can also offer opportunity for criminal activity. As urbanization increases there is a coincidental increase in the incidence of criminal activity along natural area trails, often

leading to requests from the public and law enforcement agencies to completely alter the native ecosystem by removing valuable vegetation. This request is founded in the need to increase user surveillance of the trail area, and to limit concealment of criminals within natural area vegetation. Wholesale vegetation removal is harmful to the natural area ecosystem, a 1994 study, "*Effects of Vegetation on Crime in Urban Parks*", found that "modifying vegetation may have little effect on park crimes".

Law enforcement agencies utilize the concept of **Crime Prevention Through Environmental Design** (CPTED) to deter criminal activity. CPTED operates to prevent crime through designing a physical environment that positively influences human behaviour—people who use the area regularly perceive it as safe, and would be criminals see the areas as highly risky places to commit crimes. In keeping with the principles of CPTED and to provide safe use of natural areas, trail design, maintenance and operation elements should be integrated into access management plans for natural areas as follows:

1. The trail design standards and specifications described in the proposed Trail Classification of this document address key elements of the CPTED concept: concealment, surveillance, prospect, and escape. The "surveillance area" specification, is defined as the area on each side of the trail where specialized vegetation management is conducted, is based on pruning and trimming of vegetation in order to reduce concealment of perpetrators and increase the prospect of detecting perpetrators by park users.

2. Natural area parks should offer a trail network that meets the many needs of park patrons. General access and recreation trails should be provided in sufficient numbers to maximize user safety as these trails have wide tread and surveillance areas that promote safe passage. And, while nature trails should also be provided for experiencing nature through urban hiking, they do have narrow treads and little or no surveillance areas, and may be more risky to use.

3. Informational and educational signage should be used to inform park patrons of the risks associated with using natural area trails. For instance, trail network signs should be installed at access points to describe the design and maintenance service levels of the various trails, and to identify potential user risks. This will enable park patrons to choose a trail that meets their particular needs.

Part 3: Dog Access Strategy

Dog off-leash Facilities in Natural Areas

"Parks are for people and nature...and dogs too!?"

In 1998 the City of Surrey had a population of 47, 704 dogs with a projected population of 69, 300 dogs by 2021 (GVRD, Dog Facts). These numbers support the fact that 'fido' is an integral part of our culture and is recognized as contributing positively to the human milieu. Not only do dogs serve to protect humans, but much research and general opinion holds that dogs truly are "man's best friend" for they provide great companionship to young and old alike.

City Park By-law No. 13480 requires dogs to be leashed in City parks, primarily to ensure dogs are controlled by their owners and will not pose a threat to other park patrons. Despite these laws, dog owners commonly allow their dogs to run free in City parks resulting in environmental damage and increasing conflicts with other park users. The conflicts are particularly pronounced in natural areas along trails where park patrons are often suddenly confronted by an off-leash dog bounding around a trail corner. A recent GVRD study, *Canine Conundrum in GVRD Parks*, found that 18% of non-dog park patrons experienced a dog conflict, and 23% of those reported the conflict was a personal safety threat. A full 96% of the conflicts were with dogs off-leash.

According to the SPCA brochure, *Bite Free*, 500 children are hospitalized annually in Canada for dog bites. The Humane Society of the United States has found that 4-5% of children's visits to emergency rooms are due to dog bites. A recent Health Canada study, *Risk and Recreation,* 1998, revealed that, of reported bite incidents, 28.8% involved no intentional interaction with the dog. In these cases the victims were walking, in-line skating, bike riding, etc., activities that are common in most parks.

In addition to the threat of physical harm to humans from dog attacks, the presence of dog excrement can pose health hazards particularly to children who are at risk if they inadvertently eat contaminated dirt or grass. And persons confined to hand activated wheel-chairs are inordinately exposed to dog feces along natural area trails.

Natural areas are often identified as potential off-leash sites, presumably due to their geographic remoteness, low human habitation and low potential for dog/human conflicts. However, natural areas are rich in native flora and fauna. And although there is little quantifiable, scientific research on dogs and their effects to the natural environment, there are many reported and substantiated impacts. Vegetation can be affected by trampling, compaction, urinating and digging. Wildlife is flushed and disturbed by dogs, and aquatic ecosystems (including spawning grounds) are damaged when dogs swim or walk in creeks.

The City has an informal off-leash area in Dogwood Park where considerable damage to the natural vegetation has been reported, particularly in the forested area of the park. Many trees have been damaged to the point where their removal has been necessary.

Studies and reports clearly attest to the risks and impacts involved in allowing dogs in natural areas, particularly when permitted to be off-leash. The following list summarizes those risks and impacts.

- Disruption of wildlife
- Adverse environmental effects
- Surface water contamination
- Impacts from overuse
- Threats and risk to park patrons for dog attacks
- Dog fights
- Noise complaints from immediate neighbours
- Parking problems

At the present, demands for off-leash dog areas have not been fully addressed within the City; however, the Parks, Recreation and Culture Department is currently undertaking a public planning process to identify one off-leash area for each City Town Center. The Department recognizes the need to provide off-leash areas. They are places where dogs can run free and play with their owners, and where dog owners can more easily exercise and socialize with other dog owners. Additionally, approved off-leash areas will assist with reducing the incidence of illegal off-leash use of other park areas, thereby reducing user conflicts and ecosystem impacts.

Recommendations for Natural Area Off-Leash Facilities

Natural areas may not provide the best location for dog off-leash areas, but sometimes there may be a need to devote parts of a natural area to off-leash facilities. Given that 65% of current parkland is natural area, it seems a reasonable expectation that some off-leash areas would be designated in natural areas.

Although the success of an off-leash dog facility is dependent upon a host of design guidelines and principles, the following guidelines are specifically recommended as necessary for dog off-leash facilities and best protect the natural area.

1. Develop facilities in natural areas of low environmental sensitivity.

Areas of low environmental sensitivity, populated with hardy, common native flora and with a low population of common wildlife, could be considered. Avoiding natural areas of moderate to high environmental sensitivity would help protect significant flora and fauna. Mixed forest communities, wetlands, riparian areas, and old field habitat should be avoided.

2. Segregate off-leash facilities to reduce conflicts.

To effectively reduce user conflicts, minimize environmental degradation and reduce City liability exposure, off-leash facilities need to be fenced and signed. Most specifications for off-leash facilities now require a minimum four-foot fence and adequate signage to inform the public of the rules and risks inherent when entering an off-leash facility.

3. Consult with the general public and other stakeholders prior to the development of dog parks.

It is essential that the public and other stakeholders, both dog and non-dog owners, be involved in the development of dog parks. No natural area should be designated a dog park without broad public support, for once a dog park has been established there will be great resistance among dog owners to its removal.

4. Consult with other cities and organizations that have developed dog parks.

Many cities in both Canada and the USA have developed dog parks. Their successes and failures provide important information for consideration when developing these types of facilities.

5. Fence dog parks.

Experiences in other cities have shown that dog parks are more acceptable to the general community when they are fenced. Fenced off-leash areas keep dogs from venturing into areas where they are not welcome and prevent disruption to wildlife, sensitive ecosystems and other park users.

In cities where off-leash hours have been permitted within unfenced areas of existing parks, non-compliance with regulations is common and complaints are numerous. Fenced areas dedicated, as off-leash parks will help to alleviate this problem.

Surrey has an advantage over many other cities for it has available, undeveloped parklands that may be suitable for dog parks. Cities without undeveloped parklands must rely on existing park spaces, where changes in use patterns are often resented by non-dog owners, or where fenced areas may not be possible.

6. Design dog parks to prevent overuse.

The number of dog parks and the size within them are important considerations. There should be enough park space to meet the demand without causing site degradation. Grassy pasture areas are most popular for dogs, but when overused they become compacted and muddy. Good drainage and appropriate surface materials are essential in high traffic areas. These areas should be surfaced with wood chips, gravel or concrete.

7. Ensure adequate parking.

Adequate parking for both cars and bikes must be provided. Otherwise users will park in front of private residences, resulting in neighbourhood resentment and complaints to the City.

8. Provide adequate signage and educational pamphlets.

Signage must clearly outline the rules and regulations, and the fines that can result from non-compliance. It can also provide educational information for dog owners. This information can also be made available in educational pamphlets and distributed at dog parks and other sites within the City.

9. Provide proper disposal facilities for excrement.

Health issues due to improper disposal of dog excrement can be a major concern. To keep the area clean and safe, garbage cans with proper lines, plastic scoops and disposal bags should be provided.

10. Encourage the development of dog park associations and volunteer groups.

Organized volunteers can greatly assist the City by contributing to maintenance activities and by patrolling dog parks to ensure that park rules are followed. They can also help to enhance the parks by providing water dishes and toys, planting shade trees, putting in extra seating and providing educational seminars.

11. Develop effective regulations and ensure uniform enforcement.

It is essential to develop regulations for off-leash dog areas. Because non-compliance is common, regular enforcement supplemented by volunteer monitoring is required.

Appendix A

Natural Area Trail and Pathway Specifications

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