GUIDELINES FOR DETERMINING SETBACKS AND BUFFERS

Setback is defined as the distance measured from a rear lot line or edge of developed area to an identifiable natural heritage feature. The width of the setback will be determined on a site specific basis and will take into account geotechnical assessments and hazards, an ecological buffer zone to protect features of the natural heritage system and other needs such as corridors and rights-of-way (Figure 1).

The purpose of a setback is to separate two land uses so that conflicts and impacts are minimized, and to protect individuals and property from natural hazards. The setback may be used to control access and encroachment to the buffer and to adjacent natural areas.

Buffer zone is an area within a setback that is required for the protection of natural heritage features and ecological functions. Key ecological functions may include, but are not limited to, acting as a filter to minimize impacts from adjacent land use, providing linkage as a wildlife corridor around or between habitats and contributing to habitat and species diversity. Establishment and maintenance of buffer zones may involve natural successional processes or require planting of native vegetation.

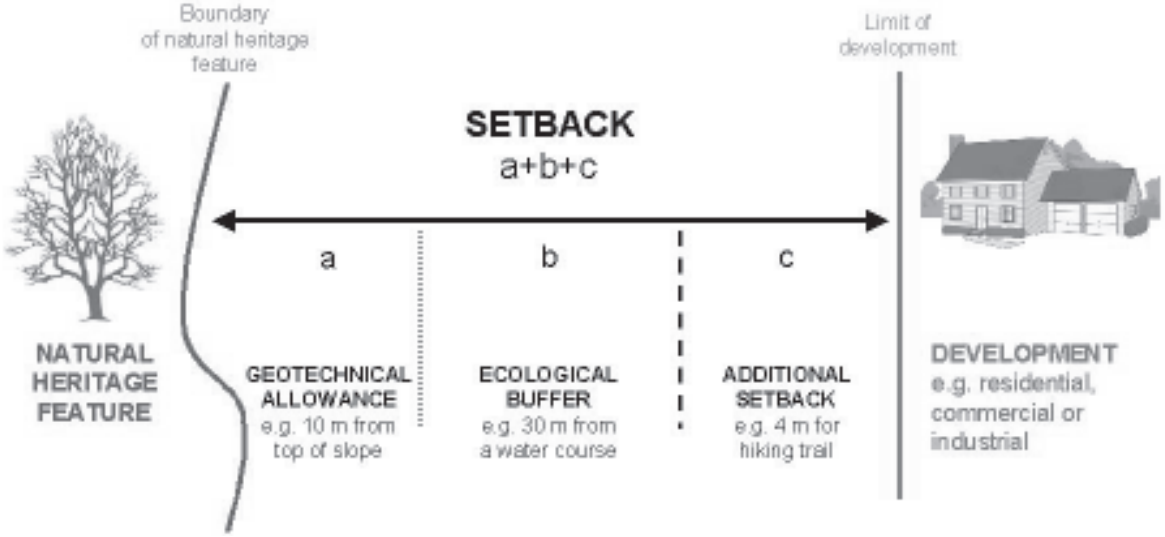

Figure 1. Components of a setback.

The purpose of a buffer is to minimize impacts on natural heritage features and functions and to maximize the long term viability of native species and natural systems. Appendix A lists some of the edge effects experienced at the boundary of natural areas.

The width of the setback and the type of buffer required will depend on:

1) the function and features of the natural heritage feature and their sensitivity to disturbance;
2) site- specific topography, hydrology and soils;
3) existing and future land uses; and
4) the required land uses within the setback (e.g. site stability, ecological buffer, rights-of-way and access.

Because of great differences in site specific requirements for setbacks and buffers, a standardized approach for determining setback distance is not recommended. Rather setbacks should be determined based on minimum distances required for buffers to protect ecological features and functions plus other considerations listed in 2-4 above.

The process of establishing setbacks and buffered requires:

1) identification of the features and functions that need to be protected;
2) consideration of the natural and development land uses involved;
3) identifying potential impacts;
4) determining setback requirements ; and
5) creating a buffer management plan.

Setback and buffer limits should be clearly marked on all plans used during construction and staked in the field. Silt or snow fence construction will normally be required at the boundary of the buffer to prevent entry of construction equipment or stockpiling. Contractors should be familiarized with the limits of disturbance during pre-construction consultation on site.

Determination of buffer width:

A buffer will be required whenever development occurs adjacent to a natural heritage feature. The width of the buffer will depend on the type and sensitivity of the feature. In general, the wider the buffer, the more protection it provides. Best available information suggests the following minimum buffer widths are appropriate, and necessary to provide protection for natural features and maintain ecological function.

Feature	**Minimum buffer width recommended**
Wildlife habitat	100 m
Woodlands	10 m beyond the drip line of trees (protects the rooting zone).
Wetlands	30 m for water quality benefits. Ratio of 3:1 of upland to wetland habitat area for protection of small wetlands.
Watercourses	30 m from the high water mark. 50 m + 0.5 m per 1% of slope for cold water streams.
Corridors	100 m (urban) and 200 m (rural).

Buffer widths may be increased depending on the expected impacts from the development and the sensitivity of the features and functions being buffered. Table 1 outlines potential impacts from different kinds of development. Table 2 outlines sensitivities of natural features and levels of impact expected.

Buffer width should be measured from the boundary of the natural feature. Guidelines for assessing and determining boundaries for woodland patches and other natural heritage features are given in Section __. Normally the edge of a natural feature will be determined and staked in the field during a site visit as part of the Initial Consultation stage of Phase I of the EIS process. Old field and other non-treed, cultural habitats that are not wetlands may be included in the buffer where they are present adjacent to a woodland patch and not included in the boundary of the patch. The effectiveness of the buffer will be enhanced if it contains a variety of habitat types.

At least the minimum buffer width should apply unless compelling evidence is provided that shows the natural heritage feature or function will be adequately protected by a narrower buffer. The geotechnical allowance (zone a) may be included in the buffer when appropriate except for slopes >25%, that must not be included in the buffer width. Any setback that is less than 30 m wide must be enhanced through a rehabilitation, enhancement and planting plan. Enhancement and rehabilitation is recommended for all ecological buffers.

The boundary of the buffer must be outside the development zone, that is beyond rear lot lines and beyond areas of grading or fill. Septic tanks, stormwater management facilities, holding tanks and impervious surfaces are not permitted in the buffer. Permitted uses in a buffer should be similar to those in the adjacent natural heritage feature. Buffers are subject to extensive encroachment in urban areas. Part of the development agreement should include an information package about the purpose of buffers and permitted uses for adjacent property owners.

All planting that occurs within a ecological buffer must be of native species of local provenance.

Determination of geotechnical allowance:

A geotechnical allowance is required when a slope, flood plain or other natural hazard is present.

Feature	Minimum geotechnical allowance required
Valleys, slopes and ravines	6 m from change in contour from slope to tableland or 6 m beyond the top-of-stable-slope based on 100 year erosion line and a geotechnical assessment, whichever is greater. A geotechical assessment is required for steep (>3:1) slopes, or those with active toe erosion.
Streams and rivers	Edge of floodplain or flood fringe.

Determination of additional setback:

There is no minimum width for additional setbacks such as rights-of-way beyond the buffer and geotechnical allowance. Additional setbacks may be required for recreational trails, sewer lines, stormwater management facilities, access and so on. Grading, filling and the construction of trails may be permitted in the additional setback. Where possible rehabilitation and enhancement of the additional setback should be done. Plans for setback enhancement and management may be included as part of the buffer enhancement plan.

Determination of the setback cannot take away all economically beneficial use of the property. Buffer averaging, density compensation, conservation easements and variances may be used to minimize negative economic impacts where necessary.

Table 1. Potential impacts associated with different land uses.

LD: Low density residential
MD: Medium density residential
HD: High density residential
CO: Commercial or industrial operation including high intensity livestock operations
SC: School
PA: Parkland, including sports fields

	Land Use					
Potential Impacts	**LD**	**MD**	**HD**	**CO**	**SC**	**PA**
Artificial lighting	L	L-M	M	H	M	H
Litter and garbage	L	L-M	M	M	H	M
Yard Waste/ Compost/ Refuse	H	H	L	L	L	L
Increased access to sensitive areas	H	H	H	L	H	H
Creation of new trails, off-trail trampling	H	H	H	L	H	H
Increased trail use - compaction, erosion, damage	M	M	H	L	H	H
Tree damage (trunk and limb removal, forts, etc)	M	M	M	L	H	L
Increased noise levels	L	L	LM	H	M	M
Decreased infiltration and increased run-off volume	L	M	L	H	L	L
Increased erosion	L	M	L	H	H	L
Increased nutrient, pesticide and sediment input	M	H	H	L	H	H
Visual intrusion/ loss of quality of experience	L	M	H	H	L	L
Domestic animals: faeces, predation on wildlife, etc	H	H	M	L	L	H
Introduction of invasive plants	H	H	L	L	L	L
Increase in urban wildlife species	M	H	L	H	L	L
Air pollution - emissions, smoke, aerosols	L	M	H	H	L	L
Fire hazards	L	L	L	L	M	H

L = low impacts expected, M = moderate impacts, H = high level of impact expected.

Table 2. Features of the natural heritage feature and proposed development to be considered when determining buffer and setback widths. Buffers should be greater where sensitivity is high, or where impacts are likely to be high.

Character of Natural Feature	Highest Sensitivity	Lowest Sensitivity
Aspect	South and West facing edges	North and East facing edges
Community maturity	Mature	Pioneer
Height of vegetation	Tall trees	Shrubs and non-woody plants
Edge type	New edge or no mantle	Well developed mantle
Slope	Steep slope, >10%	No slope, flat or undulating
Direction of slope	Development uphill	Development downhill
Substrate subject to erosion	Poor drainage, tills and clays	Open drainage, sands and gravel
Landscape cover	High forest cover in regional landscape (2 km radius) - metapopulations	Low forest cover in regional landscape (2 kn radius) - metapopulations
Riparian vegetation	Little or no riparian buffer along length of watercourse	>75% of water course with vegetation buffer
Groundwater	Groundwater recharge or discharge area	Neither recharge or discharge area
Surface water	Headwater area	Downstream area
Species present	Priority birds, area sensitive species, interior species, highly conservative species,	Edge species, generalist species, adventive exotics
Existing land use in buffer	Trees or woody vegetation such as plantation or cultural thicket	Open area, active agricultural land

Table 3. Relative impacts of development.

Character of the Development	Highest Impact	Lowest impact
Scale of the development	Large, ie. community plan	Single residence
Effects of infiltration	Hardened surfaces	Permeable surface retained, infiltration allowed
Landuse practices	Conventional techniques	Best management practices employed
Buffer ownership and management	Private or individual ownership as in rear yard buffers	Public or conservation ownership and management
Fences and barriers	Unfenced or open	Fenced lot lines
Potential impacts (Table 1)	High risk of impacts	Low risk of impacts

Appendix A

EDGE EFFECTS OF NATURAL AREAS

Edge The portion of an ecosystem near its perimeter, where influences of the surroundings prevent the development of interior environmental conditions.

Edge effect refers to the distinctive species composition or abundance in this outer portion.

Impaction The accumulation of materials on surfaces is higher at the forest edge (e.g. fog, mist aerosols, mineral nutrients, pesticides and toxins).

Edge width of a vegetation patch: The edge width extends from the perimeter of a patch towards the centre to the point where there is no significant change on proceeding towards the centre. Microclimate used as a measure of edge width will give minumum value. Other variables used to determine edge width may include plants and/or animals (mammals, birds, insects) and measure cover, density, biomass, stratification, species richness, species composition etc.

Range of different edge widths measured:

Insects:	metres to tens of metres
Vegetation:	metres to tens of metres
Human effects in suburbans woods:	tens of metres
Microclimate:	tens of metres to hundreds of metres
Insectivorous birds:	tens of metres to hundreds of metres
Butterflies:	hundreds of metres
Small mammals:	hundreds of metres
Nest predators:	hundreds of metres
Large mammals:	thousands of metres

(from Forman, R.T.T. 1995. Land mosaics: the ecology of landscapes and regions. Cambridge University Press and based on various sources)

Edge microclimate: Sun and wind are the overriding controls of the edge microclimate. They determine which plants survive and thrive as well as having a major impact on soil, insects and other animals. The ecological effects increase with the difference in vegetation height between adjacent ecosystems.

- South-facing edges are wider than north-facing edges.
- Windward edges are wider than leeward edges.
- The *mantel* plays an import role in determining forest edge width.
- New edges will be wider than older edges.

Environmental factors affected by edge include light, evapotranspiration, temperature, temperature fluctuation, carbon dioxide levels and snow melt. Sand, silt, snow, seed and spiders accumulate at the forest edge because of the sudden drop in wind speed. Wind speed: Air velocity upwind of a forest is typically reduce for a distance of about 8h (8 times the height of the trees). Downwind the wind speed is reduce for 25h or more. Turbulence zones in these areas may be a source of erosion and dust. Wind penetration into a forest increase for about 1h on the upwind side, but the elevated wind speed on the downwind forest edge is only about 0.5 h.

E***dge aspect effect***: Maximum light is experience in summer for N-facing edges and in spring and fall for S-facing edges.

Residential development and neotropical migrant birds: The number of houses surrounding a forest seriously undermine its suitability for neotropical migrants. Neotropical migrants consistently decrease in diversity and abundance as the level of adjacent development increase, regardless of forest size. "Current planning regulations generally permit housing right up to forest edges. This practice may prevent protection of ecological features within the forest." Friesen, L., P.F.J. Eagles and R.J. Mackay. 1995. Conservation Biology 9(6):1408-1414.

Encroachment: Encroachment always occurs when residential developments are built next to natural areas. Encroachment may include dumping garden refuse in the natural area, creating access, management and manicuring, building structures or other activities. Encroachment is usually more pronounced where the backyards are not fenced, especially when the rear lot line is within the natural area.