



Policy Title: Slope Adaptive Development Guidelines Policy and Conservation Planning and Design Policy

Policy Number: LUP008

Report Number: LPT2008-83, CPC2009-042

Approved by: Council

Effective Date: 2009 March 9

Business Unit: Land Use Planning and Policy

BACKGROUND

At the 2006 April 24 Public Hearing, Council approved recommendations of the Calgary Planning Commission to direct administration to scope a project to establish city-wide Council Policy on Slope Adaptive Subdivision and Construction.

This document provides flexible guidelines and preferred options to assist in the site planning, design and development of sloped terrain in a safe and slope adaptive manner. Additionally, the document contains a voluntary methodology, process and tools for the conservation of identified natural, cultural and historic features which may otherwise be developed and are not protected under existing policies and legislation.

PURPOSE

The purpose of the Slope Adaptive Development Guidelines Policy is to:

1. Provide policy guidance to Administration, Calgary Planning Commission and Council in the evaluation of slope adaptive development applications.
2. Assist developers, builders, consultants and homeowners to effectively develop land through unique and innovative construction techniques and practices on sloped terrain.
3. Ensure the type, distribution and densities of development are compatible with the natural systems, terrain and geologic character of sloped lands.
4. Establish flexible guidelines that protect the aesthetic qualities of sloped lands, emphasize visual quality and encourage the use of innovative design techniques and innovative construction techniques which minimizes the disturbance and simulates the natural topography of sloped areas.
5. Though not a statutory document there is an expectation that policy be respected

POLICY

[See attached document](#)

PROCEDURE

[See attached document](#)

AMENDMENTS

None.

City of Calgary
Slope Adaptive Development Policy and
Guidelines
&
Conservation Planning and Design Guidelines



Proposed Document
January 2009
City of Calgary
Land Use Planning &
Policy

Note: The Proposed document contains minor wording amendments to Part A, 2.0 Purpose, and Part B, 5.0 Tools For Implementation, as recommended by Calgary Planning Commission on 2009 January 22nd and by the Standing Policy Committee on Land Use, Planning and Transportation on 2009 February 18th.

Publishing Information

TITLE: SLOPE ADAPTIVE DEVELOPMENT POLICY & GUIDELINES & CONSERVATION PLANNING AND DESIGN GUIDELINES

AUTHOR: LAND USE PLANNING & POLICY
PLANNING, DEVELOPMENT AND ASSESSMENT

STATUS: PROPOSED - 2009 JANUARY

PRINTING DATE: 2009 JANUARY

ADDITIONAL COPIES: THE CITY OF CALGARY
RECORDS & INFORMATION MANAGEMENT (RIM)
DEVELOPMENT & BUSINESS APPROVALS
P.O. BOX 2100, STN "M" #8115
CALGARY, ALBERTA T2P 2M5

PHONE: 311 OR OUTSIDE CALGARY 403-268-2489

FAX: 403-268-4615

WEB: www.calgary.ca/planning/landuse

CLICK ON: Publications

SLOPE ADAPTIVE DEVELOPMENT POLICY AND GUIDELINES & CONSERVATION PLANNING AND DESIGN GUIDELINES TABLE OF CONTENTS

PREFACE	1
PART A: SLOPE ADAPTIVE DEVELOPMENT POLICY AND GUIDELINES	2
1.0 INTRODUCTION.....	2
2.0 PURPOSE.....	2
3.0 PLANNING HIERARCHY AND SLOPE ADAPTIVE DEVELOPMENT POLICY AND GUIDELINES INTEGRATION.....	2
3.1 Municipal Development Plan (MDP) (MGA Section 632)	3
3.2 Area Structure Plan (ASP)/Area Redevelopment Plan (ARP) (MGA Sections 633 and 634).....	3
3.3 Outline Plan/Land Use Application/Development Application	3
3.4 Development Permit for Stripping and Grading	4
4.0 SLOPES DEFINED.....	4
4.1 Slope Measurements	4
4.2 Slope Stability	4
5.0 APPLICABILITY	5
6.0 REGULATED COMPONENTS OF SLOPE ADAPTIVE DEVELOPMENT.....	5
6.1 Permitted and Discretionary Uses	5
6.2 Retaining Walls	5
6.3 Grading	6
6.4 Landscaping and Screening	6
6.5 Building Height	6
6.6 Drainage.....	6
6.7 Tree Retention & Removal Plan (LOC and/or DP stage)	6
7.0 SLOPE ADAPTIVE DEVELOPMENT POLICY AND GUIDELINES APPROVAL PROCESS.....	6
7.1 Application Requirements	6
7.2 Analysis to Define 'Land Areas of Interest' (ASP or ARP stage).....	6
7.3 Site Survey of 'Land Areas of Interest' (LOC Stage).....	7
7.4 Geotechnical Report for 'Land Areas of Interest' (LOC Stage)	7
7.5 Preliminary Grading Plan (LOC Stage).....	8
7.6 Preliminary Drainage Plan (LOC Stage).....	8
7.7 Erosion and Sediment Control Plan (LOC Stage)	8

APPENDIX A - BEST PRACTISES GUIDELINES	9
1.0 How To Use These Guidelines	9
1.1 Site Planning & Design	9
1.2 Roads & Driveways.....	10
1.3 Grading & Earthworks.....	11
1.4 Storm Water Management.....	16
1.5 Municipal Services & Utilities	17
1.6 Architectural Form.....	17
1.7 Landscape Design & Natural Vegetation.....	18
APPENDIX B – PLANNING HIERARCHY, SUBMISSION REQUIREMENTS.....	20
DEFINITIONS	21
PART B: CONSERVATION PLANNING AND DESIGN GUIDELINES.....	22
1.0 INTRODUCTION.....	22
2.0 PURPOSE.....	22
3.0 GOALS AND OBJECTIVES.....	22
3.1 Conservation Planning and Design Development Site Layout.....	23
4.0 GUIDELINES FOR APPLICATION OF CONSERVATION PLANNING AND DESIGN.....	24
4.1 Conservation Planning and Design.....	24
4.2 Density	24
4.3 Site Layout and Design	24
5.0 TOOLS FOR IMPLEMENTATION.....	25

Preface

This Slope Adaptive Development Policy and Guidelines and Conservation Planning and Design document has been undertaken at the direction of City Council and addresses three topic areas:

- 1) Methods for slope adaptive development for both developing and developed areas of Calgary.
- 2) Identifying the City standards and review processes for the safe development of sloped terrain.
- 3) Process for the voluntary application of conservation planning and design.

The document is not intended to replace existing City policy, but rather to support existing policies and provide greater detail and preferred options for the development of sloped areas, as well as to outline a process for the voluntary conservation of natural, cultural and historical features. The document is a non-statutory document and as such it is to be interpreted and implemented in support of existing City of Calgary bylaws, standards, policies and processes including the Land Use Bylaw, subdivision application review and approval process, and slope stability review and construction safety standards.

Part A of the document identifies the level of slope adaptive planning and analysis at each level of the City of Calgary planning hierarchy, including the identification of sloped land areas of interest early in the planning process, through the preparation and review of Area Structure Plans and Area Redevelopment Plans. The document contains Best Practices Guidelines for slope adaptive development, which contain a range of guidelines and preferred options for development. These are to be interpreted with flexibility allowing the applicant to pursue creative options which best apply to the specific area or site.

The document identifies the existing City process and required analysis of sloped lands relative to their ability to safely support development, and reinforces that safe development is the top priority for slope adaptive development.

Part B of the document identifies a methodology and process for the voluntary application of conservation planning and design for the conservation of identified natural, historical and/or cultural features which may not be conserved through existing policies or legislation.

PART A:

SLOPE ADAPTIVE DEVELOPMENT POLICY AND GUIDELINES

1.0 INTRODUCTION

Sloped lands present unique development opportunities and contribute to the attractiveness of neighbourhoods and the entire City. Conventional flat land development approaches, when applied to slopes, can lead to soil loss, erosion, and excessive stormwater runoff, loss of biological habitat, landform changes and higher infrastructure costs. In order to ensure the sensitive development of sloped lands into the community design process, specific design guidelines coupled with a definitive analysis and review process is required. These elements will ensure that both future development and redevelopment is compatible with the sensitive nature of these lands.

Slope adaptive development is a form of development that is designed to complement and accommodate existing sloped lands. Development may be defined as built structures (residential, commercial or industrial), recreational open space or landscaping. Slope adaptive development implies that the subject lands are fully developable under the *Municipal Government Act (MGA)*, therefore the development should apply the techniques contained herein to achieve a development that is designed to complement the integrity of the slope on which it is sited.

2.0 PURPOSE

The purpose of the Slope Adaptive Development Policy and Guidelines is to:

1. Provide policy guidance to Administration, Calgary Planning Commission and Council in the evaluation of development applications on sloped terrain.
2. Assist developers, builders, consultants and homeowners to effectively develop land through unique and sensitive construction techniques and practices on sloped terrain.
3. Ensure the type, distribution and densities of development are compatible with the natural systems, terrain and geologic character of sloped lands.
4. Establish flexible guidelines that protect the aesthetic qualities of sloped lands, emphasize visual quality and encourage the use of innovative design and construction techniques which minimize the disturbance and simulates the natural topography of sloped areas.
5. Though not a statutory document there is an expectation that policy be respected.

3.0 PLANNING HIERARCHY AND SLOPE ADAPTIVE DEVELOPMENT POLICY AND GUIDELINES INTEGRATION

The Policy Plans listed herein are statutory and non-statutory plans. They are presented in the sequence that they occur in the stages of land use planning, and are also identified in Appendix B: Planning Hierarchy and Submission Requirements.

Appendix A contains Best Practises Guidelines, including illustrations, to aid the interpretation of the policy guidelines. The guidelines are intended to guide applicants and the Approving Authority in the submission and processing of slope adaptive development applications. They are provided as supplementary to the policy. They are provided to inspire, promote and encourage unique design approaches.

3.1 Municipal Development Plan (MDP) (MGA Section 632)

The *Municipal Development Plan* is a statutory plan that addresses future land use within the municipality. It outlines the vision, objectives and general policies to achieve sustainable development in Calgary. The Slope Adaptive Development Policy and Guidelines are intended to align with the MDP vision, objectives and policies.

3.2 Area Structure Plan (ASP)/Area Redevelopment Plan (ARP) (MGA Sections 633 and 634)

Area Structure Plans (ASP) and Area Redevelopment Plans (ARP) are statutory plans. ASPs provide a framework for subdivision and development of an area through the Outline Plan/Subdivision Application process. ARPs provide for the redevelopment of developed areas of the city through the Subdivision, Development Permit and Building Permit processes.

3.2.1 Plan Integration

During the preparation of an Area Structure Plan (ASP) or Area Redevelopment Plan (ARP), sloped land areas of interest shall be identified. Where the subject lands are deemed to be sloped, in accordance with Section 4.0 of this document, site layout, orientation, infrastructure, slope stability and development capacity and density should be considered, in addition to design and development guidelines elements, to the satisfaction of City Council. Areas of steep slopes will be mapped and identified within the applicable ASP or ARP.

In order to determine whether the Slope Adaptive Development Policy and Guidelines will apply, the following submissions will be required to become part of the preparation of an Area Structure Plan (ASP) and/or Area Redevelopment Plan (ARP):

a) Topographical Analysis

Significant areas of a site (e.g. greater than 20% of an area that is contiguous and can be logically planned) with a slope of 20% or greater trigger the need for the application of the Slope Adaptive Development Policy and Guidelines. A detailed topographical analysis will be required at the ASP stage in the planning process. Given the broad approach to this stage of planning, it is required that slopes found in developed areas will require site specific topographical analysis including a visual inspection of the site.

b) Slope Stability Analysis/Geotechnical Report

This report should be submitted to the satisfaction of the Approving Authority and will become part of the ASP/ARP as for any slopes greater than 20%.

c) Alignment With *Land Use Bylaw 1P2007*

Should specific regulations be required that are not provided for in *Land Use Bylaw 1P2007*, they should be identified at this stage of planning. Such regulations should not contradict *Land Use Bylaw 1P2007*, and any proposed amendments to *Land Use Bylaw 1P2007* should be identified in detail. Supplementary regulations in the ASP/ARP should provide visual illustrations where applicable.

3.3 Outline Plan/Land Use Application/Development Permit Application

Outline Plans are prepared as an initial stage in major subdivision applications, usually in outlying areas. They are non-statutory. Following the approval of the ASP/ARP which identifies the 'Land Areas of Interest' that fall within

the slope adaptive development guidelines in the ASP/ARP, the next stages in the planning process are the Land Use Application/Outline Plan and Development Permit applications.

Commencing at the Outline Plan/Land Use amendment application stage, more detailed topographical information will be required by the Approving Authority. A preliminary grading plan should be provided. Grading of sloped lands should be complementary to the existing, natural slope of the site. The preliminary grading plan should illustrate retaining walls and should illustrate how the proposed grading closely reflects the existing slope to be altered for the proposed development.

3.4 Development Permit for Stripping and Grading

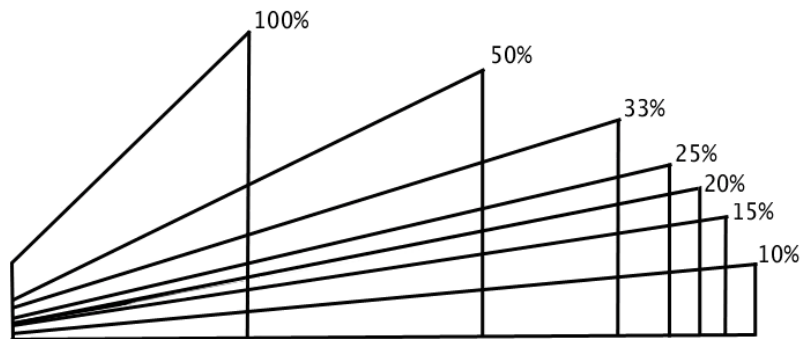
Following the approval of a tentative plan of subdivision, a Development Permit for stripping and grading must be obtained.

4.0 SLOPES DEFINED

Slope is the measure of change in vertical distance over a horizontal distance. For example, an elevation rise of 100 metres over a distance of 200 metres describes a 50% slope.

4.1 Slope Measurements

For the purposes of this document, slopes defined as 'Land Areas of Interest' are those lands in their natural state that have a slope angle greater than 20%.



4.2 Slope Stability

It is recognized that slope steepness does not necessarily relate to the stability of slopes. Slope stability is a function of, but not restricted to, soil material, moisture content, groundwater condition, slope geometry, and vegetation cover. Consequently, slope steepness should not be considered the sole determinant of the development potential of land. A geotechnical evaluation and slope stability assessment will provide essential technical information on the geologic condition and stability of the slope.

Slides tend to occur most often on slopes between 30-60% and the potential for erosion is present on much shallower slopes. Standard City geotechnical practice supports development on slopes up to 33% (3:1). Avoiding development on slopes of 33% or more is essential to public safety. Slopes between 15% and 33% may be developed where the integrity of the existing slope is retained; however, the applicant shall demonstrate, through a

slope stability analysis and creative design solutions, that risks to public safety can be mitigated. Development on slopes in excess of 33% is discouraged, as the engineering of these slopes to accommodate development defeats the purpose of these policies and guidelines. However, where slope stability and safety can be demonstrated to the satisfaction of the Approving Authority, slopes in excess of 33% may be considered for development. Where slopes are considered to be “unstable” by the Approving Authority, they may be dedicated as Environmental Reserve, as identified in the *Municipal Government Act*.

SUMMARY
SLOPES DEFINED

- **20%-33%:**
Slopes in this range shall be defined in future ASP and ASP amendments as ‘Land Areas of Interest’ (e.g. Slope angle of 20% or greater, with greater than 20% of an area that is contiguous and can be logically planned). The development of these lands will be guided by the Slope Adaptive Development Policy and Guidelines as part of the submission of an Outline Plan/Subdivision application. In developed areas these slopes will be identified as part of the land use/development permit application and follow the Slope Adaptive Development Policy and Guidelines. Note, slopes in excess of 15% require slope stability analysis as per City standards and submission requirements. The slope adaptive guidelines applies to those slopes with a slope angle of 20% or greater and does not regulate slope stability or safety.

- **33% or greater:**
Development on slopes greater than 33% is to be avoided.

5.0 APPLICABILITY

The guidelines outlined in this document apply to residential, industrial, commercial or recreational development on lands with a slope of 20% or greater, in developing and developed areas.

6.0 REGULATED COMPONENTS OF SLOPE ADAPTIVE DEVELOPMENT

It is anticipated that the elements listed below in this section shall be regulated through the planning mechanisms outlined in Section 3.0. Each slope adaptive development component must meet the provisions of *Land Use Bylaw 1P2007*. Further guidance relating to retaining walls, grading, landscaping and drainage is contained in Appendix A: Best Practices Guidelines.

6.1 Permitted and Discretionary Uses

Under the provisions of *Land Use Bylaw 1P2007*, the land use district applied at the Land Use/Outline Plan Application (LOC) stage dictates the associated permitted and discretionary uses.

6.2 Retaining Walls

Both building and development permits are required for retaining walls greater than 1 metre in height or for a series of retaining walls where the combined slope is greater than 3H:1V.

6.3 Grading

Slopes constructed to accommodate the built form should complement existing grades, shall comply with *Lot Grading Bylaw 32M2004* and all City of Calgary grading and geotechnical standards.

6.4 Landscaping and Screening

New development should complement existing topography and the natural environment.

6.5 Building Height

Building height in sloped areas shall be in accordance with *Land Use Bylaw 1P2007*.

6.6 Drainage

Drainage regulations shall be in accordance with *Drainage Bylaw 37M2005*.

6.7 Tree Retention & Removal Plan (LOC and/or DP stage)

A Tree Retention and Removal Plan shall be submitted as per City standards, for slopes in excess of 20%.

7.0 SLOPE ADAPTIVE DEVELOPMENT POLICY AND GUIDELINES APPROVAL PROCESS

7.1 Application Requirements

Lands that have been identified as 'Land Areas of Interest' through the Area Structure Plan (ASP) or the Area Redevelopment Plan (ARP) process will be subject to the Slope Adaptive Development Policy and Guidelines. Where 'Land Areas of Interest' have been identified for the application of the Slope Adaptive Development Guideline Policy at the Land Use/Outline Plan Application (LOC) stage, and LOC approval has been granted on this basis, subsequent subdivision approvals will be coordinated with prior LOC approvals to ensure that the integrity of the slope, as approved through the previous LOC application stage, is not compromised with future subdivision approvals.

In addition to the standard requirements for development applications within the City, the following is a more detailed description of the components required in support of development applications on sloped lands.

7.2 Analysis to Define 'Land Areas of Interest' (ASP or ARP stage)

A 'Land Areas of Interest' analysis report shall be conducted on lands with a degree of slope greater than 20% for an Area Structure Plan (ASP) or Area Redevelopment Plan (ARP). It is intended to provide basic information about the Plan Area's physical characteristics and significant features. The intent of this information at the ASP/ARP level is to identify, early on in the planning process, 'Land Areas of Interest' which will require more detailed analysis at the next stages in the planning and development process. It is recognized that not all sites will contain all elements listed, and that there may be other unique site-specific considerations. The City may waive certain elements of the analysis or require additional information. The analysis should include the following elements:

- Topographical Map.
- Geotechnical Evaluation.
- Slope Stability.
- Constraints Analysis (geology, hydrogeology, utility services, soils, wetlands, vegetation, wildlife, etc.).

The analysis should demonstrate that an appropriate assessment has been completed of the opportunities and constraints on sloped terrain including the physical and environmental factors affecting the site.

The report outlines the key results of the studies described above and summarizes this information through graphics and written text. The analysis should also overlay the key pieces of information and thereby create a composite map which clearly identifies the 'Land Areas of Interest' and the balance of the developable area.

7.3 Site Survey of 'Land Areas of Interest' (LOC Stage)

A Site Survey on the identified 'Land Areas of Interest' shall be required for submission with a Land Use/Outline Plan application (LOC) or subdivision application.

The site survey identifies the topography and natural land features of the site and should include the following information to assist in the review of the identified area of interest:

- Property lines, easements and right-of ways.
- Contour intervals appropriate to the site.
- Natural features (swales, knolls, ridgelines, rock outcrops, cliffs and slope transitions or break lines).
- Unique features.
- Existing vegetation.
- Environmentally Significant Areas (ESAs) to be determined in conjunction with the Approving Authority.
- Existing structures (roads, curbs, sidewalks, utilities, pathways, buildings, structures, fences and retaining walls).

7.4 Geotechnical Report for 'Land Areas of Interest' (LOC Stage)

As per existing City policies, in conjunction with the submission of an Outline Plan/Land Use Amendment/Subdivision application, or Development Permit/Building Permit application, a Geotechnical Report for slope stability (prepared by a qualified geotechnical engineer), is required for all sloped areas sites where existing or final design grades exceed 15% or where, in the opinion of the Approving Authority, slope stability is a concern. At a minimum, the required slope stability report should contain the following information:

- Property lines, easements and right-of ways.
- Stability limit, established with respect to most probable adverse ground water and loading conditions.
- Top of embankment or escarpment.
- Toe of slope.
- Soil types.
- Existing drainage course.
- Vegetation cover extent and type, e.g., disturbed or native.
- Where the development at the toe of slope is proposed, the report shall address the effect and extent of slope failure on the subject land and the adjacent properties and remedies to mitigate any failure.
- Erosion control and other mitigation measures, e.g., drainage works, grading etc.
- Factor of safety of 1.5 is achieved, where the resisting force is 1.5 times the level of the lateral force.

In addition to the above, it may be required in specific situations to evaluate in detail:

- Effect of ground water table.
- Building locations and foundation design.
- The effect of surcharges due to proposed structures, retaining walls and future site grading.

Refer to the City of Calgary's *Design Guidelines for Subdivision Servicing, Design Guidelines for Development Permits & Development Site Servicing Plans* for additional information on City of Calgary geotechnical and slope stability analysis requirements.

7.5 Preliminary Grading Plan (LOC Stage)

A Preliminary Grading Plan shall be submitted as per City standards, with the submission of an Outline Plan application, and will contain, where applicable, the following information:

- Identify building envelopes and accesses to individual lots or building sites, as required by the City.
- Identification of how the proposed development maintains the integrity of the slope.
- Existing and proposed topography and features in plan view.
- Hazardous and special features to be retained (e.g. cliffs, streams, rock outcrops etc.).
- The boundary of site disturbance including the area where vegetation will be retained at full build-out.
- Limit of the earthworks/grading etc.
- Indication of cut and fill areas.
- Proposed setbacks from hazardous areas and natural features.
- Proposed surface drainage.
- Approximate location, height and materials used for retaining walls.
- Proposed site development including location of roads, building lots and structures (e.g. reservoirs, booster stations).
- Key site sections.

7.6 Preliminary Drainage Plan (LOC Stage)

A preliminary drainage plan shall be submitted, as per City standards and submission requirements, for slopes in excess of 20%. The purpose of the Preliminary Drainage Plan is to provide an overview of the existing drainage system, capacities, water quality and potential for flooding and erosion.

7.7 Erosion and Sediment Control Plan (LOC Stage)

An Erosion and Sediment Control Plan shall be submitted, as per City standards and submission requirements, for slopes in excess of 20%. Refer to the City of Calgary's *Guidelines for Erosion and Sediment Control* when developing this plan.

APPENDIX A - BEST PRACTISES GUIDELINES

1.0 How To Use These Guidelines

The guidelines contained in this document are intended to be flexible and to assist both applicants and The City in preparing and reviewing proposed development(s) on sloped lands. They illustrate the issues and considerations that should be reviewed to reduce the impact of development on the existing natural landscape. The guidelines are intended to provide for flexibility in their application and to allow applicants to implement innovative and creative solutions on a site-specific basis. The guidelines are intended to be reviewed in alignment with current City processes and are not intended to create additional application review components. Specifically, Permitted Uses under *Land Use Bylaw 1P2007*, such as single detached dwellings in developing areas, are not intended to be subject to individual review under the guidelines.

Guidelines have been provided in the following areas:

- Site Planning & Design.
- Roads & Driveways.
- Grading & Earthworks.
- Stormwater Management.
- Municipal Services & Utilities.
- Architectural Design.
- Landscape Design & Natural Vegetation.
- Construction Techniques.

The guidelines in each section have been prefaced with a statement of intent. The guidelines that follow suggest the means by which the intent can be achieved. Schematic illustrations are also provided as examples, to illustrate the goal of the guideline; however, applicants may create their own design solutions that meet the overall spirit and intent of the guidelines. The following guidelines identify the desired method and form of development on sloped lands; however, they are to be interpreted with flexibility as a best practises approach for sloped land development.

1.1 Site Planning & Design

Site planning provides the foundation for effective design and implementation. As an initial step in the development process, it is essential to ensure that analysis of development opportunities and constraints is carried out in relation to the potential of the site, and in the context of the surrounding environment. Identifying sensitive areas and other development constraints will help preserve visual qualities and natural features of slopes.

Intent: *To facilitate the creation of development plans for hillside areas which respect the natural features and constraints of sloped lands.*

Guidelines:

- 1.1.1 In accordance with the City's geotechnical guidelines, including the *Design Guidelines for Development Permits and Development Site Servicing Plans*, slopes greater than 33% is discouraged.
- 1.1.2 Slope adaptive developments should be planned to minimize potential soil, geological and drainage problems.
- 1.1.3 Where pedestrian linkages are provided, routes that follow existing contour lines should be encouraged in lieu of stairs.
- 1.1.4 Site planning should be undertaken to minimize grading, maximize views, and endeavour to maintain access to solar energy.

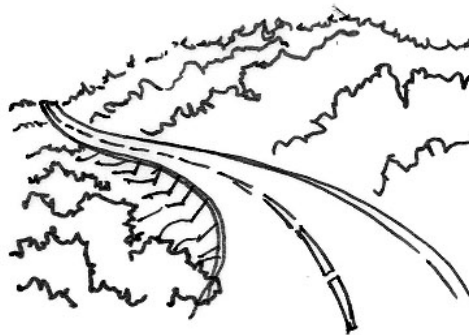
1.2 Roads & Driveways

Applying conventional road layouts and standards can lead to slope degradation and/or negative visual impacts. Reducing standard road widths and utilizing single loaded, one-way and/or split roads to avoid excessive cuts and fills should be considered at the time of preparation of an Area Structure Plan or Area Redevelopment Plan.

Intent: To encourage flexible road layouts and road widths that complement the natural topography without compromising environmental, visual and public safety objectives.

Guidelines:

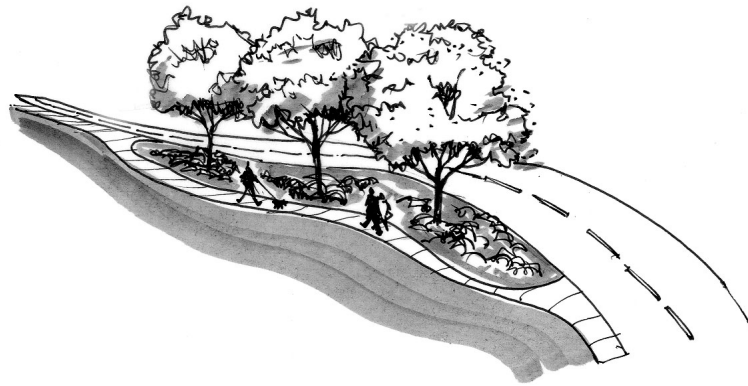
- 1.2.1 To minimize grading, roadways should be designed to complement the natural topography and conform to existing grades wherever possible.



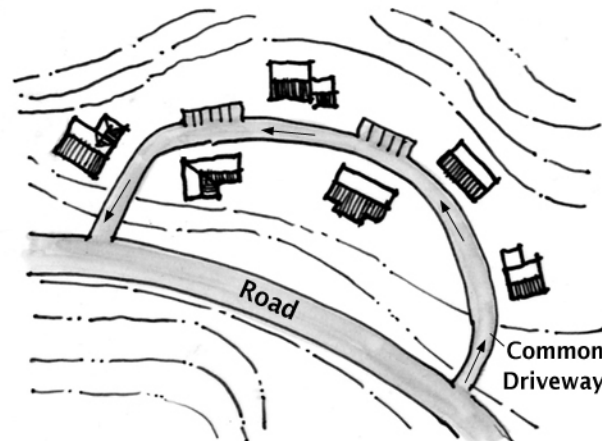
Preferred

- 1.2.2 To minimize grading driveways should reflect the natural topography as closely as possible.
- 1.2.3 The development of major collector roads and the use of grid like street patterns should be minimized on steep slopes as they are not as easily adaptable to sloped terrain.
- 1.2.4 Single loaded roads may be used to buffer key open spaces and should be designed to accommodate dwelling units on the uphill side of the street.
- 1.2.5 Road design and alignment should preserve and/or enhance significant environmental features, e.g. split roads and one-way roads. Alternative cross sectional standards may be considered to accommodate special features on a site-specific basis.
- 1.2.6 Reduced cul-de-sac radii and hammerhead road-end configurations are encouraged to avoid excessive cuts and fills, while maintaining adequate access for emergency vehicles.

- 1.2.7 Parking bays may be permitted in clustered development areas in order to accommodate topography and/or special environmental features.
- 1.2.8 The use of permeable materials on driveways, sidewalks, walkways and bike paths is encouraged to enhance storm water drainage.
- 1.2.9 Meandering or curvilinear sidewalks may be used to avoid long sustained grades.



- 1.2.10 One-way through-access driveways that exit onto a public road will be considered in order to accommodate site-specific conditions.



1.3 Grading & Earthworks

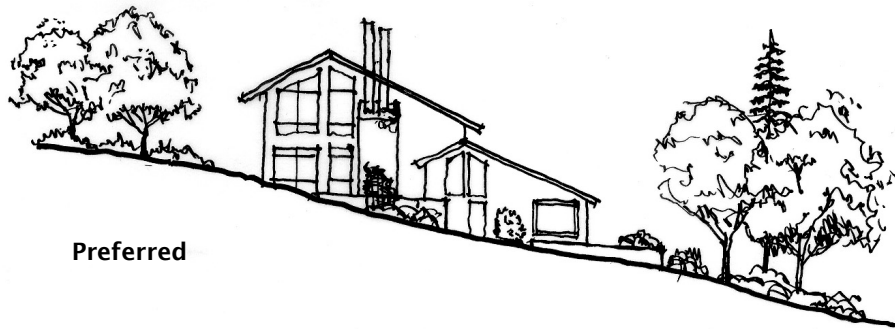
Site grading is a critical component of sloped land development as the removal or deposit of soil can significantly impact the existing topography and features of a site. During the planning stage, it is important to understand the required earthworks and mitigation measures associated with preparing a sloped site for servicing and development. This will help to reduce the impact on the existing natural environment, both physically and visually.

Intent: To protect the natural topography and existing vegetation by minimizing the amount of earthwork in developing a site.

Guidelines:

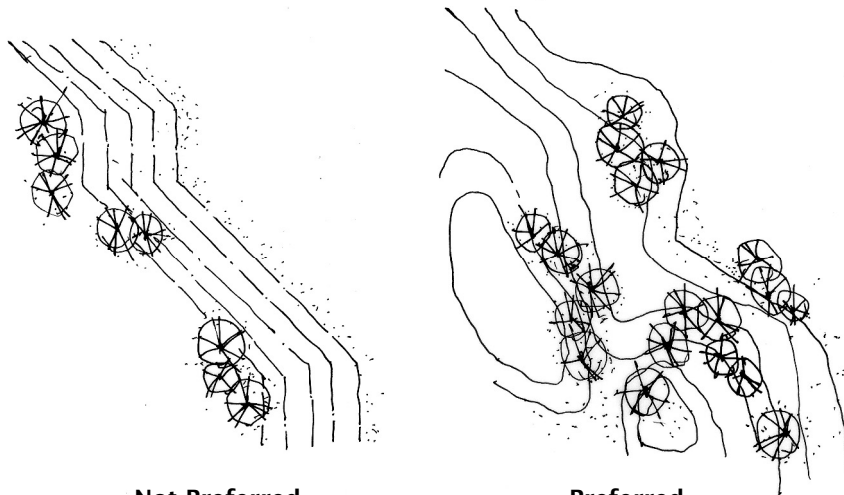
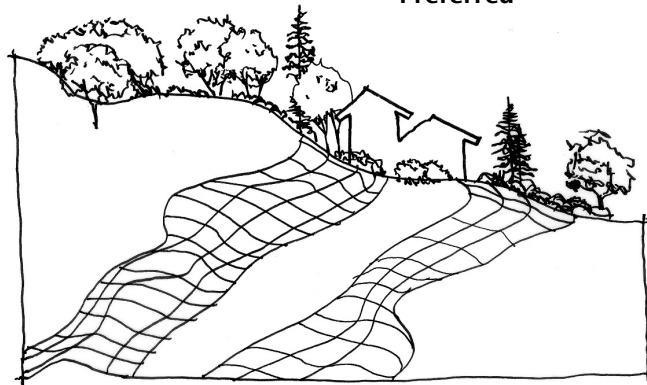
Grading

- 1.3.1 Grading shall be designed to minimize the amount of excavation and filling required.
- 1.3.2 Staged grading, and the development of smaller pads or terraces, is preferred to mass grading of an entire sloped parcel of land.
- 1.3.3 Creating large flat terraces in order to expand the developable area is discouraged.



- 1.3.4 Encourage protection of key topographic features (e.g. knolls, ridgelines, rock outcroppings, cliffs, ravines).
- 1.3.5 Finished cut and fill slopes should be constructed to compliment the existing landscape by curving with natural contours, varying slope increments and avoiding straight lines and/or geometric patterns.

Preferred



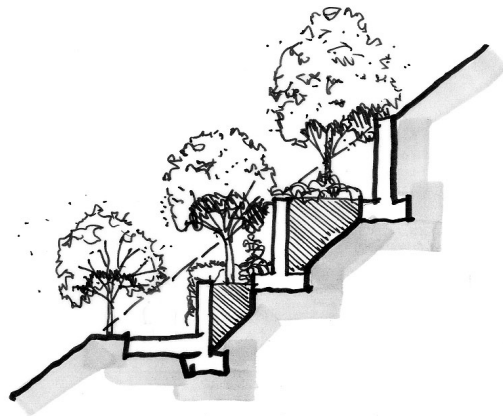
Not Preferred

Preferred

- 1.3.6** Incorporate manufactured slopes, with appropriate materials, to reduce the visual impact to the general public.
- 1.3.7** Stepped building design and terraced retaining walls should be constructed to facilitate slope adaptation to the site.

Retaining Walls

1.3.8 A tiered retaining wall system should be wide and deep enough to enable landscaping to flourish.

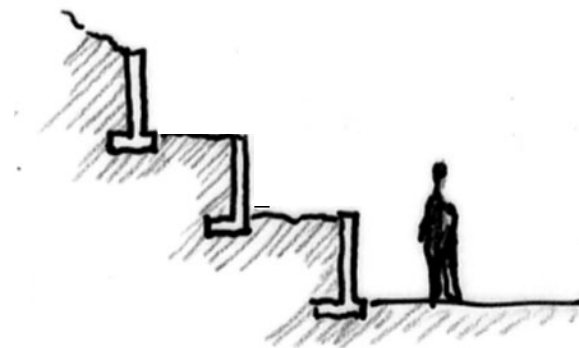


1.3.9 Retaining walls should avoid presenting large uniform wall faces through the use of tools such as screening, planting and/or textured materials.

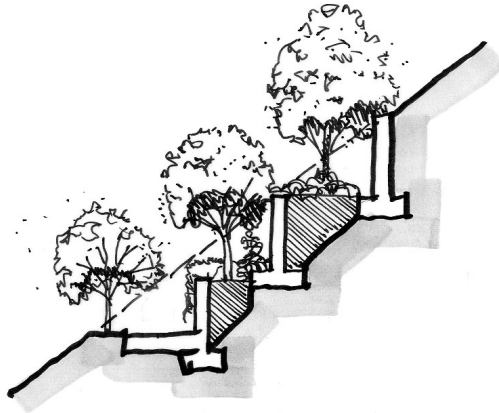
1.3.10 Retaining walls should blend with the natural environment in terms of appearance.

1.3.11 In order to minimize the visual impact of expansive retaining structures, these structures should not be higher than 1.5 metres. Where additional retaining walls are required, the use of multiple stepped or terraced walls is encouraged to avoid tall flat surfaces that restrict views.

1.3.12 Both building and development permits are required for retaining walls greater than 1 metre in height or for a series of retaining walls where the combined slope is greater than 3H:1V.

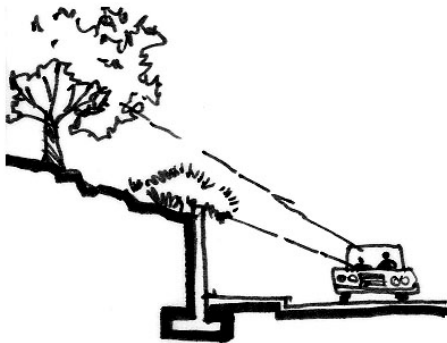


1.3.13 Retaining walls should parallel the existing slope to reduce the visual impact of retention systems.

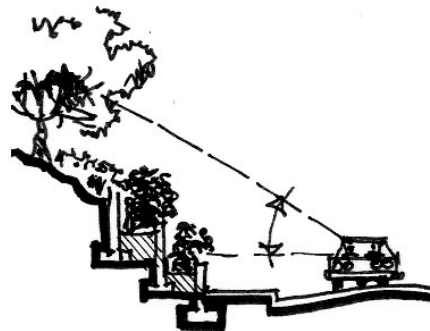


1.3.13 Retaining walls should be used in basement wall applications in order to include the retaining wall as part of the structure.

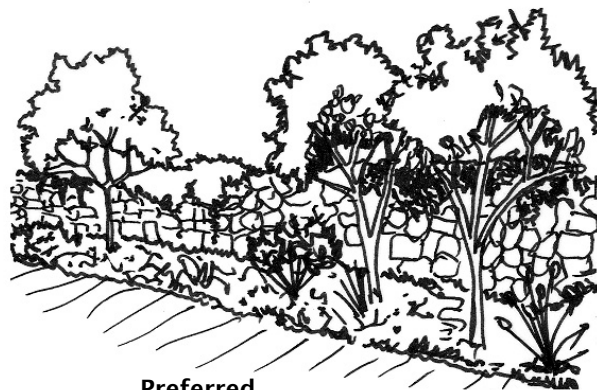
1.3.14 Provide landscaping adjacent to retaining walls, particularly along public roads. The setback for retaining walls along roads should reflect the wall height as taller plantings will require a larger growing area below the wall (see diagram below).



Not Preferred



Preferred



Preferred

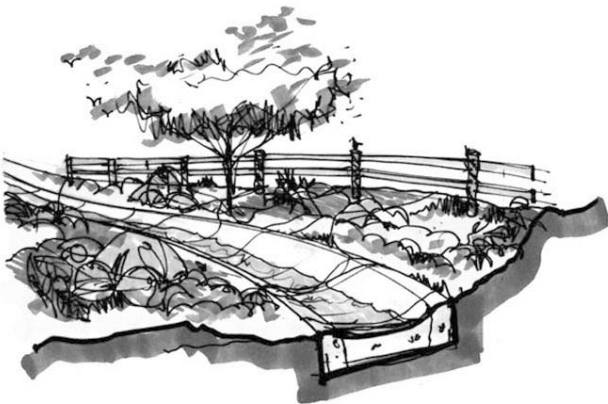
1.4 Storm Water Management

Planning for the collection, conveyance, control and treatment of stormwater that will mitigate potential impacts on steeply sloped sites is critical when planning for hillside development. Developing steep slopes will increase the amount of surface run-off and decrease the surface area for natural percolation which in turn affects groundwater environments, soil erosion and stormwater quality. The guidelines that follow provide direction on managing stormwater and should be reviewed in conjunction with current City policies, practices and standards.

Intent: *To mitigate the negative impacts of stormwater runoff by applying creative methods of reducing runoff at the source, and implementing appropriate methods for collecting and conveying surface water to prevent erosion, and improve stormwater quality on-site and downstream.*

Guidelines:

- 1.4.1 Manufactured drainage courses should be placed in the least visible locations, e.g. subsurface, and designed to simulate natural drainage courses wherever possible.
- 1.4.2 Best Storm Water Management Practices that disperse water over the subject site are preferred over channelling or underground methods, e.g. rain gardens, bio-swales, bio-retaining facilities.
- 1.4.3 Use Low Impact Development (LID) techniques to manage storm water. These techniques aim to:
 - Minimize impervious surfaces.
 - Disconnect runoff pathways (e.g. roofs, downspouts, parking areas).
 - Maintain or increase flow capacity.
 - Utilize decentralized treatment practices.
- 1.4.4 Bio-retention areas and grassed swales are encouraged as alternative systems for filtering, storing and facilitating infiltration of stormwater into the ground, where demonstrated to be efficient and effective.
- 1.4.5 Storm ditches should be designed to blend with the surrounding environment by reflecting the predominant colours and textures of the terrain (e.g. use coloured concrete or line ditches with rocks or other natural materials).



Not Preferred



Preferred

1.5 Municipal Services & Utilities

Providing cost effective municipal services to hillside developments can be challenging as additional infrastructure is required to service steeply sloped lands. For example, water systems require booster pump stations, reservoirs, pressure reducing valves and pipe anchors. Sanitary sewer systems may require additional infrastructure such as lift stations and forcemains. As a result, comprehensive pre-planning and design is required to ensure adequate system capacities are provided with no redundancies.

In addition to municipal services, pre-planning for shallow utilities is also essential. The development of utility servicing strategies will help identify infrastructure requirements such as transmission lines, telephone switching facilities, primary gas mains or pumping stations. The guidelines that follow provide direction for the provision of services and utilities on hillside areas. Services and utilities should be provided in a manner that meets the City's operational objectives, the service providers' construction and operational objectives, ensures public safety and provides cost-effective services and utilities.

Intent: *To provide municipal services and utilities on hillside developments that meet the service requirements of the future residents and minimize capital costs, maintenance and replacement costs.*

Guidelines:

- 1.5.1** Municipal services and utilities should be located to accommodate gravity-fed infrastructure.
- 1.5.2** Where possible, service lines should be located to minimize disturbance of vegetation and natural features.

1.6 Architectural Form

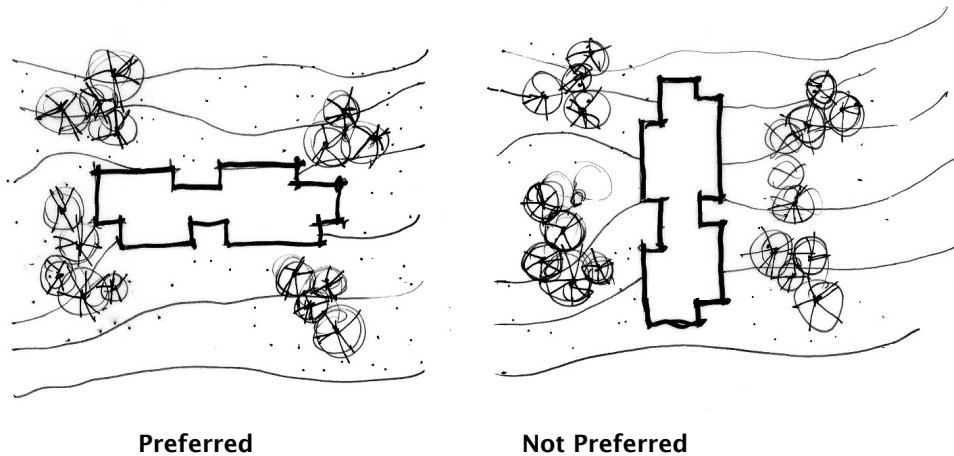
The quality of the built environment plays a significant role in the character of slope development. Slope adaptive built forms assist in minimizing the impact both visually and physically on the natural land form. The following guidelines establish general parameters of architectural design in terms of building height, massing, and other elements influencing the built form.

Intent: *To enhance the built environment through structures that respect topography and blend with the natural environment.*

Guidelines:

- 1.6.1** Lots and building envelopes should be located to minimize the impact on neighbouring structures. Where applicable, allow variation in front and side yard setbacks for building forms to avoid a repetitious appearance along the streetscape, and minimize the impact of site development on the natural environment.

- 1.6.2 Buildings are encouraged to be located to run parallel to the contours.



- 1.6.3 Structures are encouraged to be located below or behind ridgelines.
- 1.6.4 Slopes greater than 33% may be included in the building when demonstrated by the applicant that slope stability and any other constraints have been mitigated to the satisfaction of the Approving Authority.
- 1.6.5 Maintain a balance of scale and proportion using design components that are harmonious with natural landforms and landscaping.
- 1.6.6 Avoid large, unbroken stretches of wall by articulating walls and using features such as reveals, cornice detailing, alcoves, projections, trellises and landscaping to breakup the scale of the buildings.

1.7 Landscape Design & Natural Vegetation

Existing vegetation on hillsides is important to the ecological and aesthetic value of a site. In addition, vegetation serves an essential function in maintaining slope stability, drainage and erosion control. The following guidelines provide guidance on landscape design including the selective removal and retention of vegetation within steep slope environments.

Intent: *To preserve the natural character of hillsides for their visual quality and environmental significance.*

Guidelines:

- 1.7.1 Maintaining existing tree stands on sloped areas is encouraged.
- 1.7.2 Coordinate the selective removal of trees from individual building sites with site planning and architectural designs to retain the maximum amount of vegetation.
- 1.7.3 Maximize visual quality and minimize erosion potential by using existing native plants and by planting native and naturalized plants, particularly in disturbed areas, adjacent to ungraded hillsides and water courses.
- 1.7.4 When assessing the existing vegetation on the site the following should be considered:

Rationale for retaining vegetation:

- *Retains slope stability.*
- *Prevents erosion.*
- *Retains special features of the site.*
- *Provides screening of development or buffering.*
- *Is located in future open space.*
- *Helps retain rare trees and plants.*

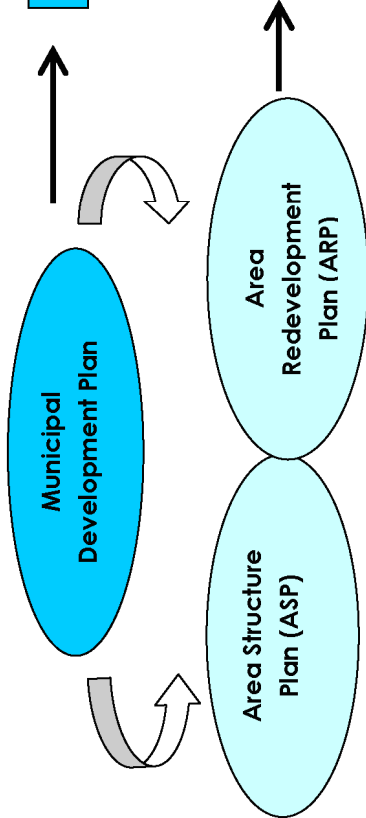
Rationale for removing vegetation:

- *Endangers public safety.*
- *Accommodates site development/improvements.*

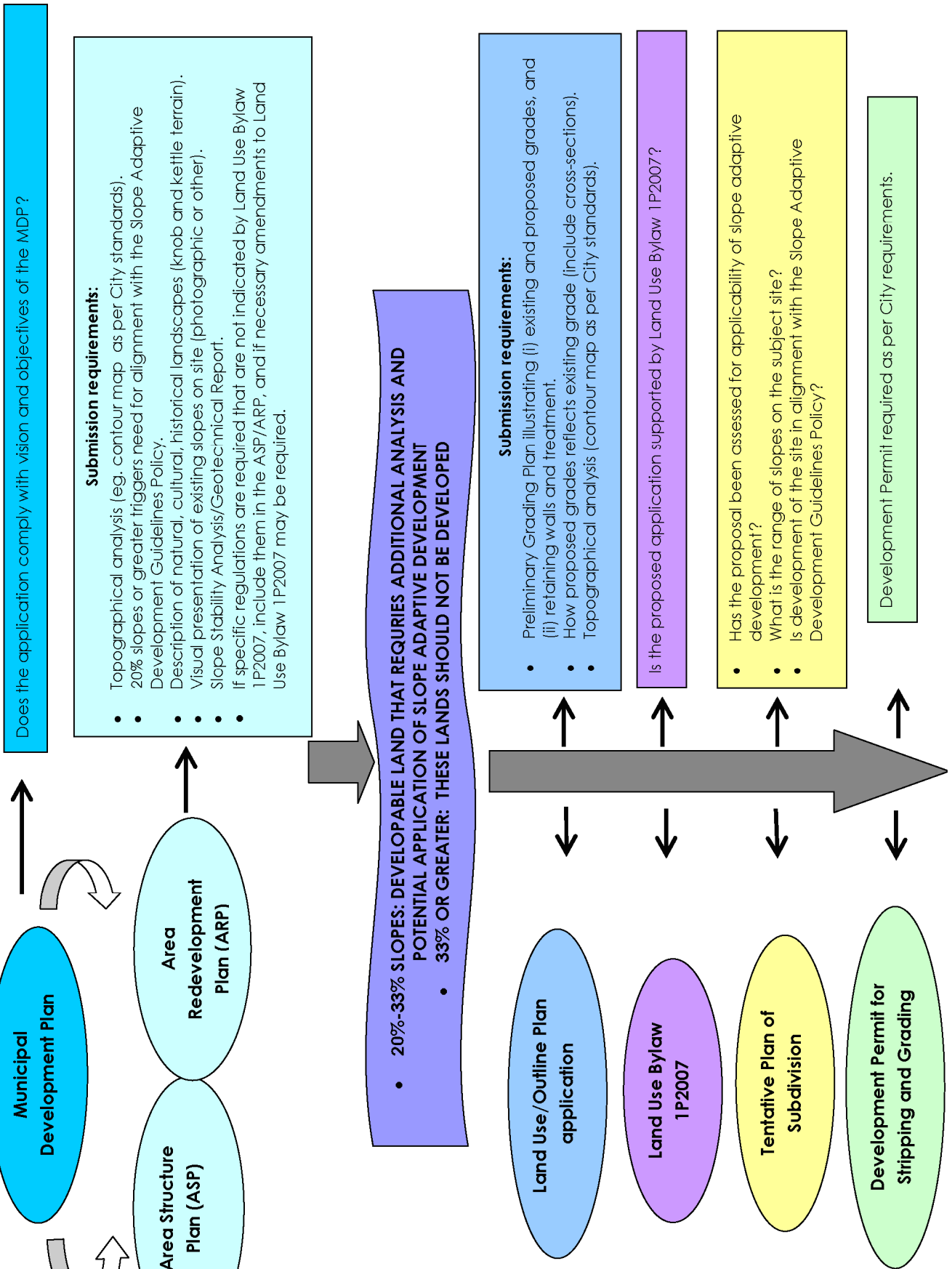
- 1.7.5** Use street planting in the front yard setback to soften the view of buildings except where trees may inhibit significant views from the site, or where trees may preclude the construction of a sidewalk, pathway or impact public safety.
- 1.7.6** Existing vegetation lines that reinforce the existing slope of the land should be maintained.
- 1.7.7** Restore disturbed areas to their natural condition as soon as possible to minimize environmental impacts, with all effort undertaken to ensure that those areas to remain in their natural condition are conserved during construction.
- 1.7.8** Where applicable, submit a restoration plan to the satisfaction of the Approving Authority.

APPENDIX B - PLANNING HIERARCHY AND SUBMISSION REQUIREMENTS

HIERARCHY OF PLANS



SUBMISSION REQUIREMENTS FOR IMPLEMENTATION OF SLOPE ADAPTIVE DEVELOPMENT GUIDELINES POLICY AT VARIOUS PLANNING STAGES



Definitions

Land Areas of Interest	Those lands in their natural state that have a slope angle of 20% or greater.
Conservation Planning and Design (CPD)	Conservation Planning and Design (CPD) is a voluntary planning tool for protecting natural, cultural or historical areas. CPD provides a voluntary avenue for incorporating the conservation of natural, cultural and/or historic lands and features into the design and subsequent approval of development proposals which would otherwise not be conserved through existing policies and legislation.
Slope Adaptive Development	Slope adaptive development is development that has been designed to complement and accommodate naturally sloped lands with a slope angle of 20% or greater.

PART B:

CONSERVATION PLANNING AND DESIGN GUIDELINES

1.0 INTRODUCTION

Conservation Planning and Design (CPD) is a voluntary planning tool for protecting natural, cultural and/or historical areas. CPD provides for incorporating these into urban site design, and the subsequent approval of development applications.

As part of Conservation Planning and Design, and at the Area Structure Plan (ASP) stage, mapping of environmentally significant areas, natural and/or cultural features should occur to identify those components located in the Plan area that may be worthy of conservation in a subdivision or development. Through CPD, and prior to the submission of an Outline Plan/Land Use Amendment application, City Administration and the applicant and their consultants where applicable, should voluntarily agree on the level of protection of lands and features, and also the level of integration of these into the design of the ASP or ASP amendments.

2.0 PURPOSE

The purpose of guidelines and principles is to provide for the voluntary enhanced protection of environmentally significant areas (ESA) that do not qualify as Environmental Reserve (ER), pursuant to the *Municipal Government Act* (MGA). The following guidelines and principles also apply to those natural, cultural and historical features not conserved under other applicable policies and/or legislation.

The conservation of areas and features may be achieved by clustering development around those areas and features identified as being worthy of conservation.

It is envisioned that the use of CPD will occur on a limited basis in the City. The use of CPD may apply to those identified significant natural/cultural/historic features, but which are deemed developable under the applicable legislation (e.g. *Municipal Government Act*), where those features are deemed unsustainable were the site to be developed under conventional developing area densities.

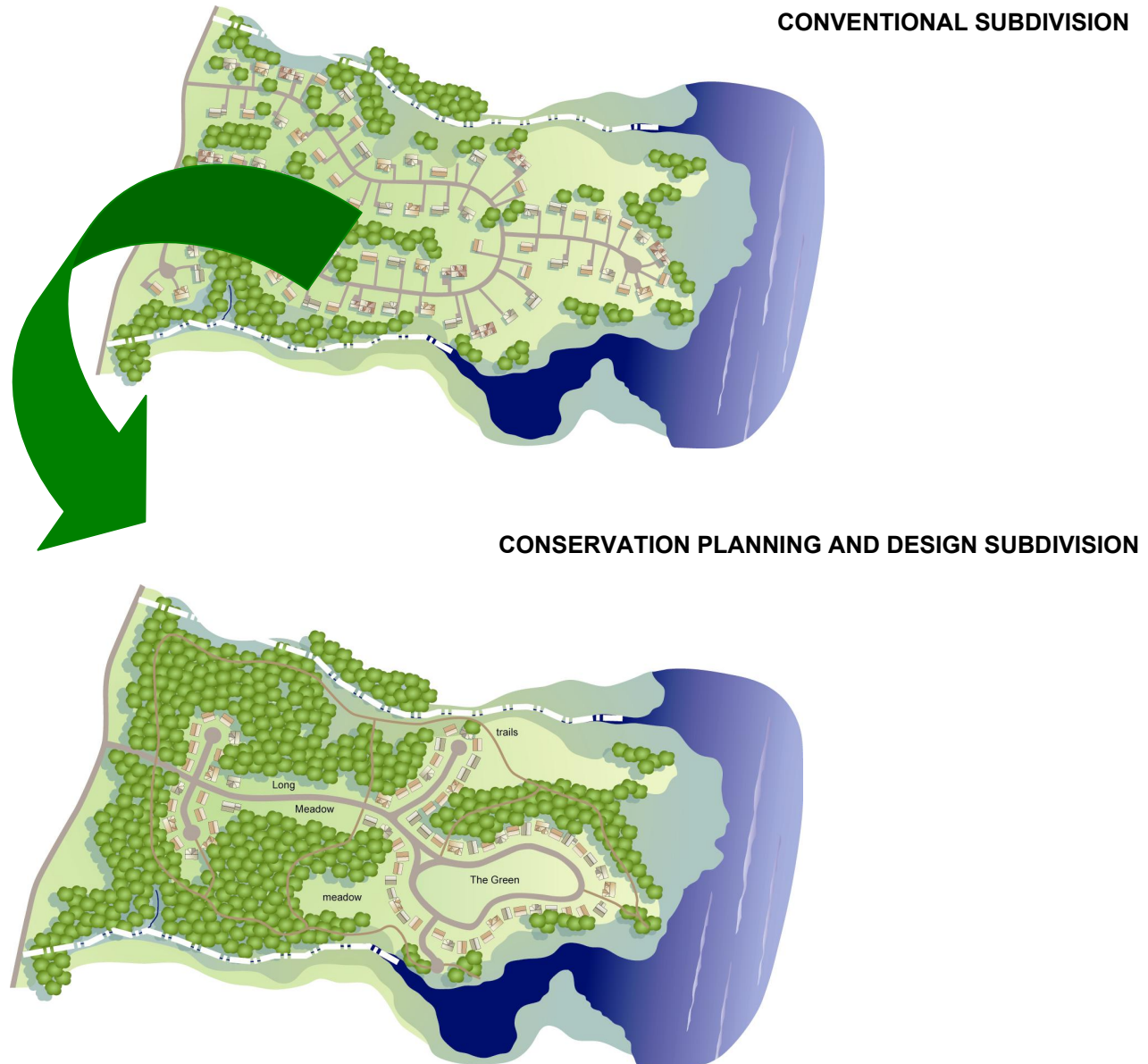
3.0 GOALS AND OBJECTIVES

- To provide a formalized structure for the voluntary conservation and protection of environmentally significant areas, not qualifying as Environmental Reserve (ER), such as important natural features, cultural or historical landscapes.
- To responsibly manage the biodiversity with the urban environment and promote excellence in environmental stewardship.
- To protect unique features (e.g. woodlots, native grasslands, cultural landscapes) within Calgary.

- To give prominence to major topographical features and the conservation of natural areas in the community design.
- To ensure quality public open space.

3.1 Conservation Planning and Design Development Site Layout

A Conservation Planning and Design subdivision is contrasted below with a conventional subdivision. The illustration demonstrates that by applying CPD, a subdivision can be improved in design, provide more open space, greater protection of trees and/or other features.



This diagram is taken from a presentation by Daniel Savard adapted from Arendt, R. (1996) Conservation Design for Subdivisions: A Practical Guide to creating Open Space Networks, Island Press.

4.0 GUIDELINES FOR APPLICATION OF CONSERVATION PLANNING AND DESIGN

The following Guidelines are procedures for the application of Conservation Planning and Design (CPD):

4.1 Conservation Planning and Design

Conservation Planning and Design (CPD) should apply to:

- (a) Sites large enough to accommodate clustering of development around features, areas and landscapes to be protected and integrated into the design of the subdivision.
- (b) Those natural features, cultural and/or historical features that do not qualify as Environmental Reserve (ER) and are deemed significant by the Approving Authority under the respective applicable criteria.
- (c) Those area(s) of the site which provide the greatest concentration of features and/or opportunities for connectivity to public open space.

4.2 Density

4.2.1 Application of Density

- (a) The gross density permitted for the entire site may be applied to a smaller development area within the entire site, subject to the satisfaction of the Approving Authority, any applicable Statutory Plans and *Land Use Bylaw 1P2007*.
- (b) For those areas which have identified significant features, which are not being conserved under existing policies or legislation (e.g. the *Municipal Government Act*), the area may be subject to a lower maximum permitted density where determined necessary to assist in the sustainment of the identified feature(s). The analysis of the feature(s), and the determination to apply a lesser minimum density than directed under the *Municipal Development Plan* for developing areas, should be determined during the preparation of an Area Structure Plan, or at the Outline Plan/Land Use amendment application stage, and should include submittal of the following information:
 - (i) An Environmental Reserve analysis identifying which features do, and which do not, qualify as Environmental Reserve under the *Municipal Government Act*.
 - (ii) An analysis of the area's natural, cultural and/or historical features to the satisfaction of the City, e.g. a Biophysical Inventory Analysis. This analysis should identify:
 - (a) The significance of each feature.
 - (b) The long term environmental sustainment of each feature on developable land. This should include identifying whether or not the features can be sustained under *Municipal Development Plan* permitted minimum densities for developing areas, or whether a lower minimum density is required to support the long term sustainment of each identified feature.

4.3 Site Layout and Design

The layout of development should aim to protect features and areas identified by the CPD assessment of the site. Site layout may vary considerably from one CPD subdivision to another; however, the layout should be designed to achieve the identified intent and purpose of CPD.

Site layout and design should include the following:

- (a) Conservation of natural areas and unique features.
- (b) Minimum density in accordance with City of Calgary policy, notwithstanding Section 4.2.1(b).
- (c) Buildings to be oriented, where possible, to benefit from sunlight and to take advantage of views on the open space.
- (d) Public access to protected space maintained by the City, the landowner and/or a combination thereof.
- (e) Connection with other natural and/or recreation areas and trails.

5.0 TOOLS FOR IMPLEMENTATION

The following are tools that may be used for the implementation of a Conservation Planning and Design (CPD) development. As CPD cannot be identified through a statutory mechanism, the guidelines may be applied by consent of the applicant at any stage of the planning and development process. The Approving Authority may utilize, in its sole discretion, the following mechanisms:

(a) Voluntary Conservation

The applicant agrees to conserve particular features or areas that are deemed worthy of conservation by the Approving Authority. Through this tool, the lands being protected are to be accessible to the public and maintained by the City.

(b) Density Bonusing

Under this tool, for every one (1) hectare of land being protected voluntarily, a density bonus of one or more units per hectare (uph) may be granted at the discretion of the Approving Authority and upon Council approval. The approach and policies for assessing and granting a density bonus, tracking and oversight of density bonusing shall be strongly encouraged and identified in greater detail in the applicable Area Structure Plan as approved by City Council, and shall be applied in conjunction with, and in consultation with, the applicant during the review of an Outline Plan/Land Use Amendment application.

(c) Conservation Easement

This tool may be applied where the landowner wishes to retain the land privately, but agrees to legally give up their rights of development. This easement becomes registered on the property's Certificate of Title.

(d) Land Use Designation

Under *Land Use Bylaw 1P2007*, the application of the Special Purpose – Urban Nature District (S-UN) provides for the protection of the types of lands and features identified within this document.

