

**City of Abbotsford**  
**McKee Peak Planning Study**

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# Part One – Background Review

# 1.0 Introduction

McKee Peak is a prominent geographic feature of Abbotsford and also comprises one of few remaining development areas in the City. The area is situated several kilometres east of the commercial centre of the community and is bounded to the north by McKee Road, to the east by Upper Sumas Mountain Road, and to the south by Lower Sumas Mountain Road and Upper Sumas IR 6. The total hillside area, including several portions with very steep slopes has only limited current development and comprises approximately 672 hectares in area.

In order to provide appropriate guidelines for future land use and development of this area, the City selected a consulting team to develop a concept plan and implementation guidelines to direct future use over this area. With exception of the eastern portion which is used for clay mining and a rock quarries, most parcels are owned by developers or owners with development aspirations. The area has been slated for development for a number of years, but access and lack of utilities have inhibited this. The Abbotsford Official Community Plan designates most of McKee Peak for residential development. The eastern rock quarry portion is identified as Limited Use, with actual use to be explored as part of this planning process. Some local plans have already been adopted for smaller portions of the area, and rezoning is also in progress for several segments of land.

McKee Peak, given its prominence in Abbotsford, has the potential to create a lasting visual impression on the community; this is an important factor to be considered as part of the planning process. The area has spectacular landscape features visible from many areas of the community.

The overall objective of this project is to map out a blueprint to guide developers and City staff in the processing of development applications, while considering the following:

- Provide for an active long range planning initiative, rather than a developer driven reactionary approach;
- Establish a mechanism(s) to acquire a substantial, natural City-wide park at McKee Peak;
- Identify and establish greenbelts and areas of no-disturbance;
- Review green space, trail, and road connectivity and access both onsite and offsite;
- Review the Official Community Plan (OCP) designation for Limited Use lands to be consistent with the Regional Growth Strategy prepared by the Fraser Valley Regional District;
- Review ways to mitigate the visual impact of developing a mountain-side;
- Develop funding strategies to assist with acquiring municipal facilities and developer cost-sharing;
- Prepare a conceptual servicing plan to guide development over the next 20 – 30 years; and
- Establish emergency access guidelines as development progresses up the mountain.

## 1.1 Study Process

The City of Abbotsford engaged the services of UMA in conjunction with Golder Associates for environmental and geotechnical analysis and Dayton & Knight for a review of the water and sewer utility to undertake the preparation of a comprehensive, long range conceptual plan for the McKee Peak planning

area. This included optimum land use definition, identifying school and park needs, transportation and servicing considerations, environmental and geotechnical considerations, and balancing this with broader community and First Nations interests.

As part of the project a public process was established that provided for regular meetings with a senior staff committee known as the City Team. In addition there were a series of meetings with owners within the study area, as well as two public sessions that allowed for a presentation of the planning options for McKee Peak, and discussion on the draft of the preferred plan. Throughout the process technical consultation occurred with other agencies as necessary.

The report is divided into four major components:

## **Part 1 Background Information Review**

## **Part 2 Developing the Concept Plan**

## **Part 3 The Concept Plan**

## **Part 4 McKee Peak Plan Policies and Recommendations**

This report provides a synopsis of each phase, and details the preferred planning concept and the associated policies prepared for the project area. Actual policies and recommendations are found in the final section (Part 4) of this report.

# 2.0 Background Information Review

## 2.1 Biophysical Overview

### 2.1.1 Slope

The study area is characterized by very steep slopes as illustrated on Figure 1 – Slope Analysis. Only approximately 57% of the area falls within slopes of 30% or less which are generally deemed as the most developable, resulting in the least road grade issues, or lot grading difficulties. The major slope classes and their respective proportions of land area are noted in Table 2-1 below:

**Table 2-1 - Slope Classification**

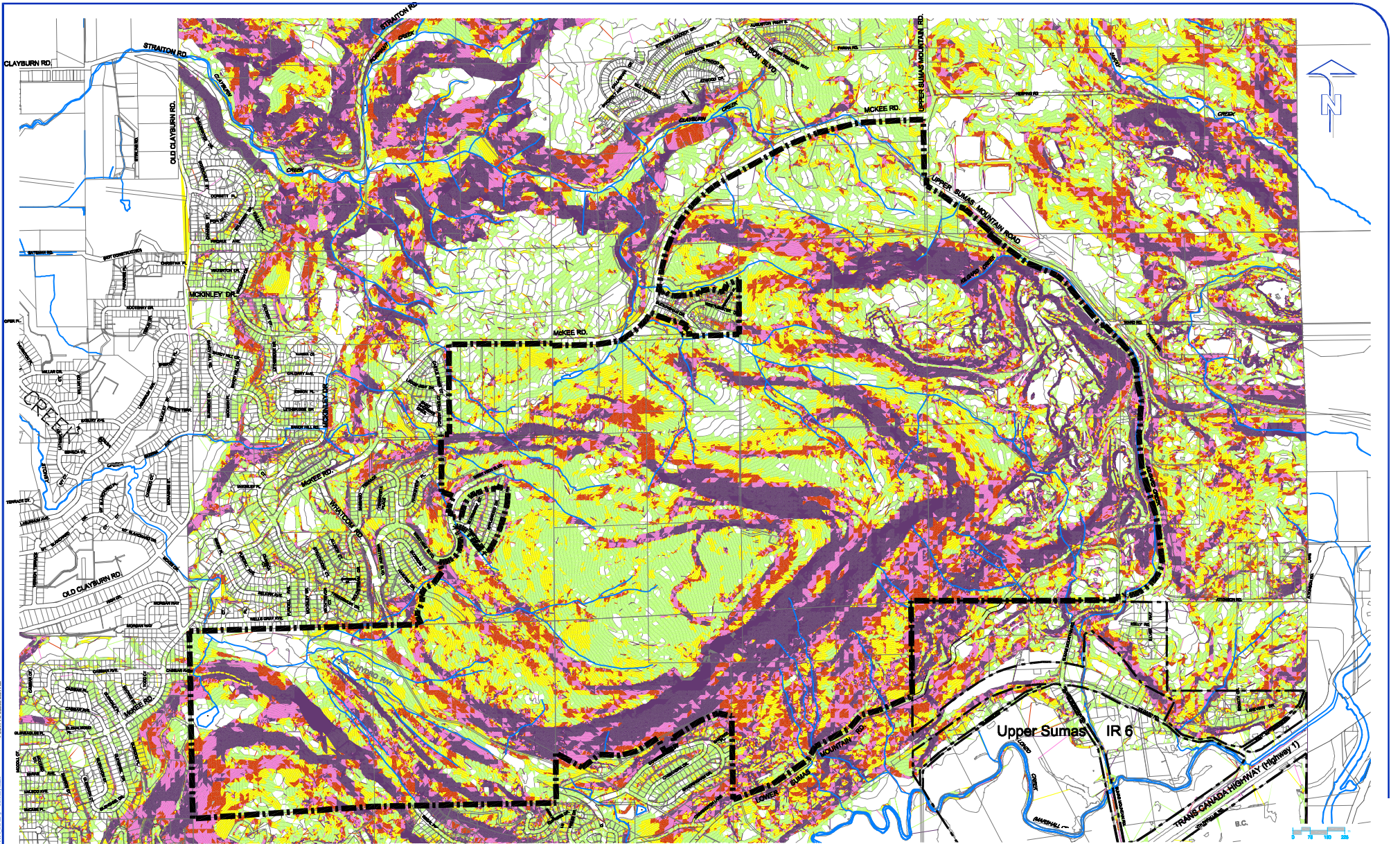
Slope range	Total Area (ha)	Percentage of Total
0 - 10.9%	102.5	15.3
11 – 20.9%	167.5	24.9
21 – 30.9 %	119.8	17.8
31 – 40.9%	82.8	12.3
41 – 50.9%	65	9.7
51% and over	134	20
<b>Totals</b>	<b>671.6</b>	<b>100</b>

### 2.1.2 Vegetation

Sensitive area identification analysis was prepared by Golder Associates of the project team. The biophysical field reconnaissance was general in nature because it was conducted during winter months rather than in the spring and summer, which is generally the most active time for mammals and birds. The field reconnaissance did not include time-sensitive surveys such as spring breeding bird surveys, small mammal trapping, or detailed vegetation surveys. Vegetation polygons were identified on a preliminary basis then field truthed. Information gathered included the following:

- Observations of vegetation and wildlife species;
- Classification of available vegetation into ecosystem or community-types;
- Observation on the use of the habitats by wildlife, including evidence of browse, food caches, nests, and burrows;
- Observations of wildlife corridors or trails, special features such as caves, waterfalls, or other unique features;
- Observations of recreational uses in the study area, such as trails, user groups, and biophysical features of recreational value; and,
- Location of wildlife trees and/or other important habitats such as raptor nests.





- |   |   |
|---|---|
| <span style="display: inline-block; width: 10px; height: 10px; border: 1px solid black; background-color: white;"></span> 0 - 10% SLOPE | <span style="display: inline-block; width: 10px; height: 10px; background-color: #e67e22;"></span> 31 - 40% SLOPE |
| <span style="display: inline-block; width: 10px; height: 10px; background-color: #27ae60;"></span> 11 - 20% SLOPE                       | <span style="display: inline-block; width: 10px; height: 10px; background-color: #e91e63;"></span> 41 - 50% SLOPE |
| <span style="display: inline-block; width: 10px; height: 10px; background-color: #f1c40f;"></span> 21 - 30% SLOPE                       | <span style="display: inline-block; width: 10px; height: 10px; background-color: #34495e;"></span> OVER 50% SLOPE |

Figure 1: SLOPE ANALYSIS





The environmental resource information is summarized in the following sections:

### 2.1.3 Aquatic Resources

Clayburn Creek and its tributaries (approximately 15) originate from the northern portion of the study area and flow in a north-westerly direction off the mountain onto the Matsqui Prairie at Old Clayburn Village, approximately 3 km from the study area. Clayburn Creek continues in a northerly direction, flowing into the Fraser River west of Matsqui Village.

Stoney Creek and its tributaries (approximately 13) originate from the western portion of the study area and generally flow in a north-westerly direction off the mountain onto the Matsqui Prairie at Bateman Park, approximately 2.5 km from the study area and into Clayburn Creek north of Bateman Road.

Kilgard Creek and its tributaries (approximately nine) originate from the eastern portion of the study area and generally flow in a southerly direction off the mountain onto the Sumas Prairie and into Marshall Creek at Sumas I.R. 6.

In addition, several unnamed tributaries (approximately six) drain the southern portion of the study area, and flow directly off of the mountain into Marshall Creek on the Sumas Prairie. It is also noted that aquatic features examined as part of this study relied on historic map information that requires ground truthing, since the level of analysis that comprised the map data was insufficient to ensure accuracy for detailed planning.

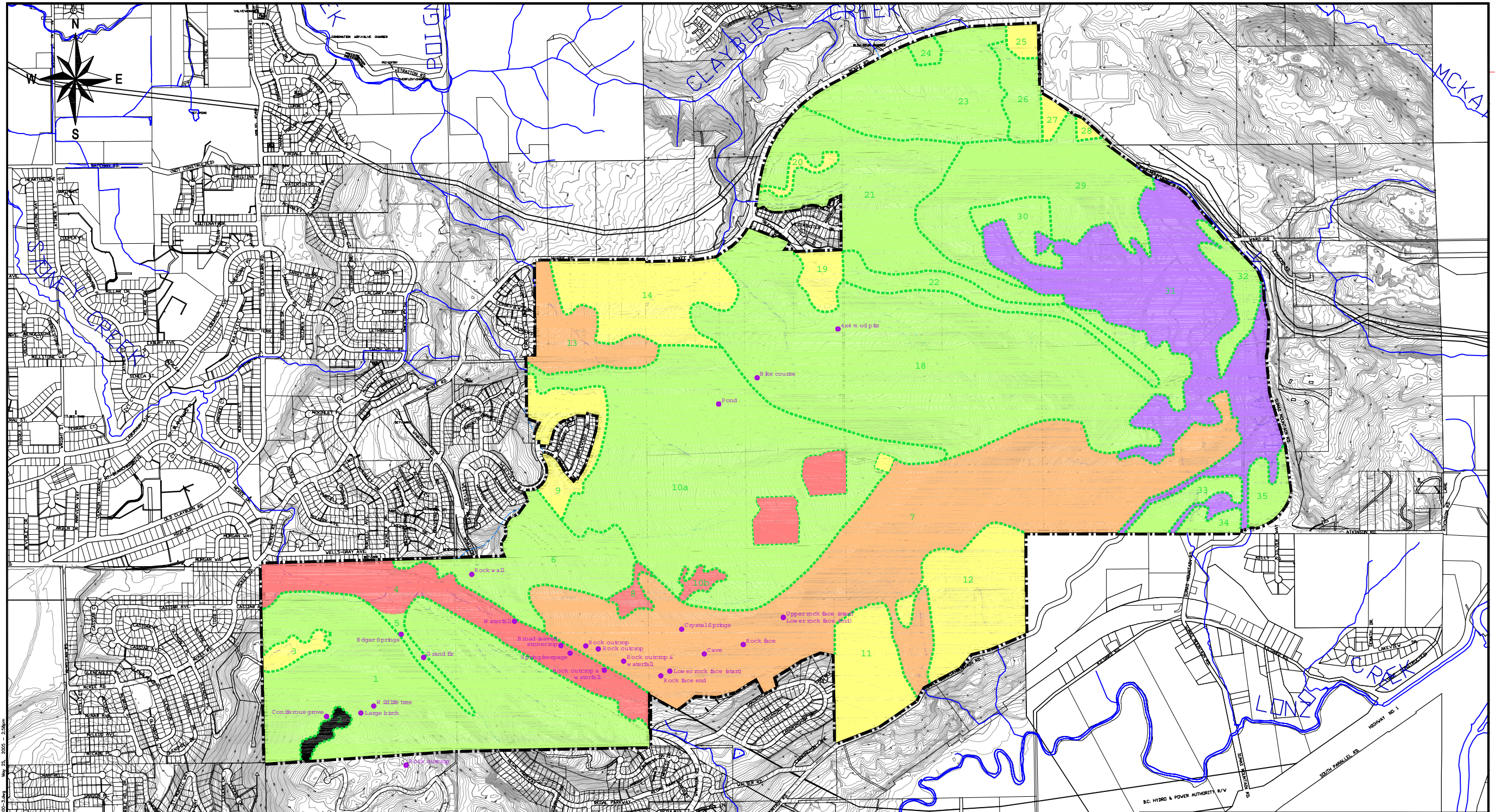
### 2.1.4 Terrestrial Resources

A Biogeoclimatic Ecosystem Classification system was developed for the Ministry of Forests to describe zonal ecosystems, primarily based on climate, as a framework for resource management in BC. According to this classification system, the McKee Peak Study Area is located within the Coastal Western Hemlock (CWH) biogeoclimatic zone. The Ministry of Sustainable Resource Management Land and Resource Data Warehouse Catalogue database (2004b; Appendix II) locates the majority of the study area in the CWH dry maritime subzone (CWHdm), which extends in a north-easterly direction to encompass most of Sumas Mountain. In contrast, parts of the south-eastern portion of the study area are located in the CWH very dry maritime subzone (CWHxm1). The areas surrounding the study area to the northwest, west, south and east are also in the CWHxm1 subzone. The CWHdm and CWHxm1 subzones are characterized as having warm, relatively dry summers and moist, mild winters with little snowfall. Vegetation analyses of the study area were supplemented by observations of naturalist Glenn Ryder. Full details are included in a background report by Golder issued to the City in a separate three ring binder (February 2005).

Figure 2 - Environmental Features summarizes the vegetation mapping from field observations, and differences in canopy composition or land cover type, moisture condition, and topography. Each polygon is described by the type of forest cover observed during the field reconnaissance. The broad land-cover types in the study area are based on the following categories observed in the field:

- Broadleaf forest;
- Coniferous forest;
- Mixed forest (broadleaf and coniferous);
- Residential / Acreage / Cleared;
- Agricultural / Open; and,
- Mine.





**LEGEND**

	Vegetation Polygon Boundary		Broadleaf Forest
	Rock wall		Coniferous Forest
	GPS Surveyed Points		Mixed Forest
			Residential/acreage/land
			Agriculture/Open
			Mire

Polygon No.	Cover Type	Polygon No.	Cover Type	Polygon No.	Cover Type	Polygon No.	Cover Type	Polygon No.	Cover Type	Polygon No.	Cover Type	Polygon No.	Cover Type	Polygon No.	Cover Type
1	MbEpDj	7	D#pMbfDc	14	acmage	20	mead/arb	26	DrWbEpAct	32	EpMbDj	Cw	Western red cedar		
2	CwFdcHw	8	open EpMbDrFdc	15	cattle area and tree fan	21	MbEpDAct	27	acmage	33	EpMbActDfDc	Ep	paperbark		
3	hebfDond	9	urban	16	cedartree fan	22	MbEpDAct	28	acmage	34	EpMbActDfDc	Pdc	Douglas-fir		
4	hebf	11	urban	17	meadow tower site	23	DActEpMbCw	29	EpMbDr	35	EpMbActDfDc	Mb	bigleaf maple		
5	MbDfDcCwBg	12	urban	18	DfEpMb	24	poth-sapping DfEp	30	poth-sapping	10a	EpDfMb	Bg	grand fir		
6	MbEpDj	13	FdcMbEpDfCw	19	acmage	25	clearing	31	mire	10b	open EpMbDrFdc	Dr	red alder		

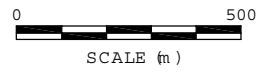
**REFERENCES**

1. JUMA ENGINEERING, CAD Files: D10, D11, D12, E11, E13, F12, F13, D1015, E1015, F1015 and Hydrology. Data Received: December 15, 2004.
2. JUMA ENGINEERING, CAD File: MckeePeak study bdy.dwg. Data Received: January 14, 2005.

PROJECT		CITY OF ABBOTSFORD MCKEE PEAK PLANNING STUDY ABBOTSFORD, BC			
TITLE		ENVIRONMENTAL FEATURES VEGETATION AND UNIQUE FEATURES			
PROJECT No.		PROJECT_NO	FILE No.	FILE_NO	
DESIGN	DESIGN	DES_DATE	SCALE	SCALE	REV. REV
CADD	CADD	CAD_DATE			
CHECK	CHECK	CHK_DATE			
REVIEW	REVIEW	RWV_DATE			

Golder Associates  
OFFICE\_PROV/STATE

Figure 2





### 2.1.5 Wildlife

The McKee Peak area supports a wide variety of both native and introduced wildlife species including large and small mammals, reptiles, amphibians, birds, and fish. Common large mammals include mule deer, black bear, coyote, beaver, and raccoon. Small mammals common to this area include the little brown bat, shrew-mole, and Douglas' squirrel. Common reptiles and amphibians in the Lower Mainland include the common garter snake and northwestern salamander. The mild climate enables this area, which encompasses the Strait of Georgia, Juan de Fuca Strait, the southwestern side of Vancouver Island, and the Lower Mainland, to be an important migratory and wintering area for raptors such as Northern harrier and red-tailed hawk. In general, the habitat types in the study area can be classified as typical of average forest, riparian forest, urban / suburban, agricultural, rocky, stream, and wetland ecosystems as per the definitions of broad habitat types. Observed species (in early 2005) included:

- Bear (observed)
- Peregrine falcon (heard and observed)
- Bald eagle (observed)
- Coyote (observed)
- Deer (pellets and bedding area)
- Squirrel (midden)
- Red-breasted sapsucker (observed)
- Pileated woodpecker (heard)
- Winter wren (heard and observed)
- Ruby-crowned kinglet (observed)
- Mallard (observed)
- Spotted towhee (observed)
- Dark-eyed junco (observed)
- Varied thrush (observed)

No raptor stick nests or heron nests were observed in the project area. However, along with audible and visual observations of a Peregrine falcon, whitewash was observed along the bluffs, likely indicating a nesting or perching site. Information on wildlife is shown on Figure 3 – Wildlife and Species at Risk.

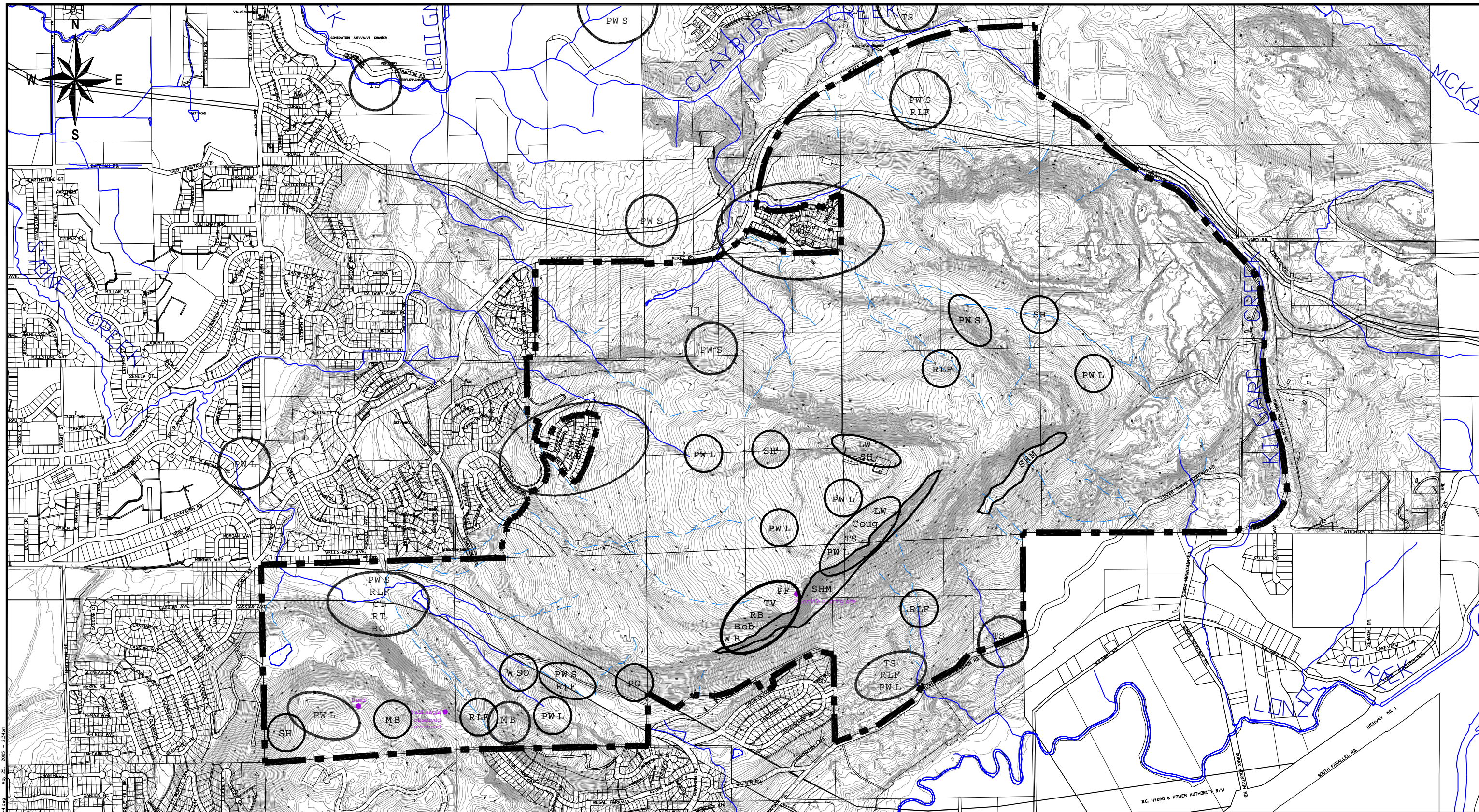
### 2.1.6 Rare and Endangered Species

A provincial rank or listing of 'red' or 'blue' species is based solely on its status within BC (B.C. Conservation Data Centre, 2004). The rankings highlight wildlife and plant species as well as natural plant communities that require special attention. The following are the provincial listing categories:

**Red** - any indigenous species, subspecies or plant community that is Extirpated, Endangered, or Threatened in British Columbia. Extirpated elements no longer exist in the wild in British Columbia, but do occur elsewhere. Endangered elements are facing imminent extirpation or extinction. Threatened elements are likely to become endangered if limiting factors are not reversed.

**Blue** - any indigenous species, subspecies or community considered to be Vulnerable (Special Concern) in British Columbia. Vulnerable elements are of special concern because of characteristics that make them particularly sensitive to human activities or natural events. Blue-listed elements are at risk, but are not Extirpated, Endangered or Threatened.





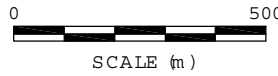
**LEGEND**


CT	Cuthroat Trout	PO	Phantom Oxtil	RB	RubberBoa	TV	Tuskey Vukum
PW S	Pacific Watershrew	RLF	Red Legged Frog	WB	Western Long-eared Bat	Beak	GPS Survey Points
PW L	Pacific Watershrew	SH	Snowshoe Ham	SHM	SilverHakMoss		
TS	Towbridge's Shrew	LW	Lew's Woodpecker	BO	Barn Owl		
MB	Mountain Beaver	Coug	Cougar	WSO	Western Screech-owl		
PF	Pennsylvanian Falcon	Bob	Bobcat	RT	Red Tail Hawk		

**REFERENCES**

1. JUMA ENGINEERING, CAD Files: D10, D11, D12, E11, E13, F12, F13, D1015, E1015, F1015 and Hydrology Data Received December 15, 2004.

2. JUMA ENGINEERING, CAD Files: MckeePeak study bdy.dwg., Date Received: January 14, 2005.



PROJECT	CITY OF ABBOTSFORD MCKEE PEAK PLANNING STUDY ABBOTSFORD, BC			
TITLE	WILDLIFE AND SPECIES AT RISK			
	PROJECT No.	PROJECT No.	FILE No. P2000-4	FILE No.
	DESIGN	DESIGN	SCALE	SCALE
	CADD	CADD	CHK_DATE	REV. REV.
	CHECK	CHECK	CHK_DATE	REV. REV.
	REVIEW	REVIEW	RWV_DATE	
Figure 3				



Federally, species ranking is conducted by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), established under Section 14 of the *Species at Risk Act* (SARA).

Red listed species noted in the McKee Peak area based on provincial rankings include (using the common names):

- Peregrine falcon
- Lewis's woodpecker
- Pacific water shrew
- Snowshoe hare
- Mountain beaver

### 2.1.7 Environmentally Sensitive Areas

The City currently has no specific designated Environmentally Sensitive Areas (ESAs). The type of candidate areas would include:

- Floral and fauna species protected under provincial and federal legislation;
- Species that are unprotected, but considered by the City as unique or important;
- Critical habitats of these floral and faunal species;
- Critical wildlife corridors or linkages between important habitats;
- Unique landforms; and
- Other environmental resources of importance to the City.

Current Best Management Practices (BMPs) can be used to guide protection of species in ESAs. While some BMPs are well established, many are under review, or in working draft stage. Environmentally Sensitive Areas generally comprise habitat or features that are important ecosystems, including those that support species at risk. Among the more critical candidate areas in the context of McKee Peak are watercourses and wetlands including riparian areas, raptor nests, rock bluffs and hazard areas, caves, mature forests, and wildlife corridors. For these areas special management and mitigative measures should be observed.

Current Best Management Practices for environmental resources include:

- 30m streamside setback under *Riparian Areas Regulations* for undeveloped forested areas.
- Buffers or leave areas around sensitive habitats or features such as a riparian area supporting a population of Pacific water shrews, mountain beaver colony, bat and reptile hibernacula, or a raptor nest.
- Proposed buffers or Development Permit Areas for habitats with medium to high potential for Pacific water shrew are 100 metres (on each side from the top of bank); and 500 metres for known Peregrine falcon and red tail hawk nests in the study area. Additional buffers may be necessary during breeding season.

Prescriptions for buffers must be used with caution, as species move around. Thus as part of any application of BMPs as well as buffers, the City should consult with habitat biologists as part of an overall environmental review on a site specific or application specific basis.

## 2.2 Geotechnical Considerations

The purpose of the geotechnical assessment undertaken by Golder Associates was to determine the range of potential natural geotechnical hazards, such as large-scale rockslides, smaller rock fall events and shallow debris slides that may affect development. The field assessment included visual examination and assessment of exposed subsoils, vegetation, soil drainage, significant landforms and apparent signs of active and/or past slope instability. Traverses were selected to provide representative cross-sections of the topography/geomorphology and/or to field check features identified during the airphoto review. A number of previous and related studies were considered as part of this review (the Geotechnical Report is found in Technical Background Material binder, February 2005).

Air photo review indicates that the McKee Peak area was extensively logged slightly before 1940, the year of the earliest air photos obtained. Photos from 1940 to 1954, prior to reestablishment of heavy tree cover, clearly show a number of steep, bowl shaped headscarp zones along and downslope of the escarpment south of McKee Peak. The westernmost feature coincides with the headscarp of the large rockslide event documented in a previous geotechnical hazard assessment. The McKee Peak area is underlain predominantly by a thick section of mid-Tertiary aged sedimentary beds. In the McKee Peak area, these rocks comprise a mainly gently west to southwest dipping (approximately 10 degree dip) sequence of predominantly sandstone and shale capped by a thick section (>100 m true thickness) dominated by erosionally resistant, pebble conglomerate.

Sandstones and shales of the lower sequence of the Huntingdon Formation host lenses of high alumina clays that have been exploited since 1905 for use as 'fireclays' for brick making. A number of open pits and underground workings are located mainly along the eastern side of the project area.

In the far south western corner of the project area (i.e. southwest of the powerline right-of-way), older granitic/metamorphic terrain forms a third topographic high. Two low northwest trending ridges occur immediately to the northeast with sedimentary beds of the Huntingdon Formation exposed along their crests. These beds dip to the northeast at approximately 45 degrees. Given the that the strike and dip of these beds is significantly different from beds northeast of the powerline right-of-way, it is considered probable that north-westerly trending block faulting has been a factor in development of the distinct topography. The bedrock escarpment that occurs locally along the northeast slope of the main hill may also be an artefact of this faulting.

Surficial geology for the area, for the most part consists of mantles of glacial till (Sumas Drift), colluvial deposits and eolian silts collectively comprising 15 m in thickness with bedrock escarpments and coarse colluvial aprons forming steeper slopes. Sandy till and substratified drift up to 10 m in thickness occur in the local valley bottoms, while alluvial sands and lacustrine silts related to the Fraser River floodplain underlie the main valley. Glaciomarine stony silts to loamy clay from 8 - 100 m thick are reported to occur to the north of the project area exposed along gullies associated with Clayburn Creek and its tributaries. Large blocks from rockslide and fragmental rockfall events were noted to occur locally.

The morphology of the main escarpment along the south slope of McKee Peak varies from a vertical, jointed face that is considered to mark the headscarp of a past rockslide/rockfall event, to steep but more subdued convex bedrock surfaces that are locally indistinct in relation to the overall sloping terrain.

Steep slopes within the project area are considered to have potential for natural geotechnical hazards such as rockslides, fragmental rockfall and debris slides. As well, seismic hazards may impact more gently sloping areas underlain by less competent soils.

### 2.2.1 Rockslides

Rockslides are defined as the failure of large masses of rock, exceeding several tens of thousands of cubic metres that lead to a sliding and flow like motion of masses of rock fragments. A large bedrock failure with

an estimated volume of failure on the order of 150,000 to 400,000 cubic metres has been identified along the escarpment south of McKee Peak, however, it is unknown whether this total volume of material failed as one event, is the result of a number of discrete failures, or represents a continuous process of erosion and toppling. Test pitting suggests that the failure is unlikely to have been a single large extensive event. The headscarp of this feature along the escarpment is distinguished by a relatively pronounced embayment in the bedrock which extends for approximately 190 m in a general northeast southwest direction.

The majority of the slide debris appears to have been deposited relatively close to the source (i.e. within 200 m slope distance from the headscarp) with large angular blocks of rock up to approximately 200 cubic metres in volume present. Based on the overall distribution of large blocks, the slide track appears to extend downslope beyond Lower Sumas Mountain Road. Some of the large blocks occurring along the lower slope are more likely to have been derived locally from steep rock headwalls of ravines located short distances upslope of these blocks.

### **2.2.2 Fragmental Rockfall**

Fragmental rockfall is characterized by the detachment of rock fragments from a steep rock slope and their gravitational downhill transport by free fall, bouncing and/or rolling. Possible triggering mechanisms for fragmental rockfall include natural events and processes such as earthquakes and ongoing physical and chemical weathering of the rock including freeze/thaw cycles and the prying action of vegetation root growth. Human activities that may initiate fragmental rockfall include incautious construction, forest harvesting operations or recreational activities. Evidence of previous fragmental rockfall was noted to occur to varying degrees associated with bedrock escarpments at each of the three topographic highs within the project area. The south slope of McKee Peak has by far the highest occurrence of large (>0.2 cubic metre) rockfall blocks. The headscarp of the large rockslide feature south of McKee Peak is marked by cross jointed bedrock that is considered to have a high potential for fragmental rockfall. Elsewhere along the escarpment that borders McKee Peak, cross jointing is infrequent and most rockfall appears to be related to undermining of conglomerate due to erosion of the underlying sandstone and shale beds. This has resulted in the formation of a number of small cave-like features along the base of the conglomerate section with potential for small fragmental rockfall from the overhanging bedrock. Toppling of large blocks is considered a more remote possibility at these sites.

Along the southern slope of McKee Peak, due to the westerly dip of the strata the conglomerate escarpment occurs at a progressively lower elevation to the west. Rockfall blocks of conglomerate have been deposited along the powerline right-of-way approximately 150 m downslope of the probable source at the bedrock escarpment. The smaller hill to the northeast of McKee Peak has been eroded to a deeper level than McKee Peak, therefore, escarpment forming conglomerate that caps the hill comprises a lesser thickness. Large blocks from previous rockfall were noted to have been deposited and confined to the gully channel downstream of this headwall area. This area was previously identified as a potential rockfall hazard by Golder (1992). Along the southern slope, large blocks were noted to have rolled downslope from spoiled waste along the upper edge of an abandoned fireclay pit.

The northwest trending bedrock escarpment that bounds the third hill in the far southwest corner of the project area (Vicarro Ranch area) is comprised of non-stratified intrusive/metamorphic bedrock that has weathered to form a moderately steep to steep (55 % to 80 % slope) colluvial apron comprised predominantly of small (<0.2 cubic metre) rock fragments. While this escarpment may be related to post mid-Tertiary faulting, no evidence was seen to indicate that rockslides or large rockfall fragments have initiated from this escarpment and run out beyond the downslope limit of the colluvial apron.

### **2.2.3 Debris Slides**

Debris slides occur when shallow soil veneer slides off of steep slopes. In the project area, steep bedrock terrain with thin soil cover is common on upper slopes and several debris slides were noted to have occurred in these areas. Golder (1992) reported that recent slides on the steep, north facing slope of the

small northern hill initiated near the slope crest from a thin mantle of till and colluvium overlying bedrock. EBA (1995) reported that a small debris slide occurred in 1990 along the northern boundary of the current Columbia National Investments property. Some of these slides are evident on historical air photos with deposition zones either on the slope or within a 50 m distance from the base of slope. Locally, jackstrawed and/or pistol butted trees on steep (>80%) upper slopes provide evidence that additional debris slides are likely to occur.

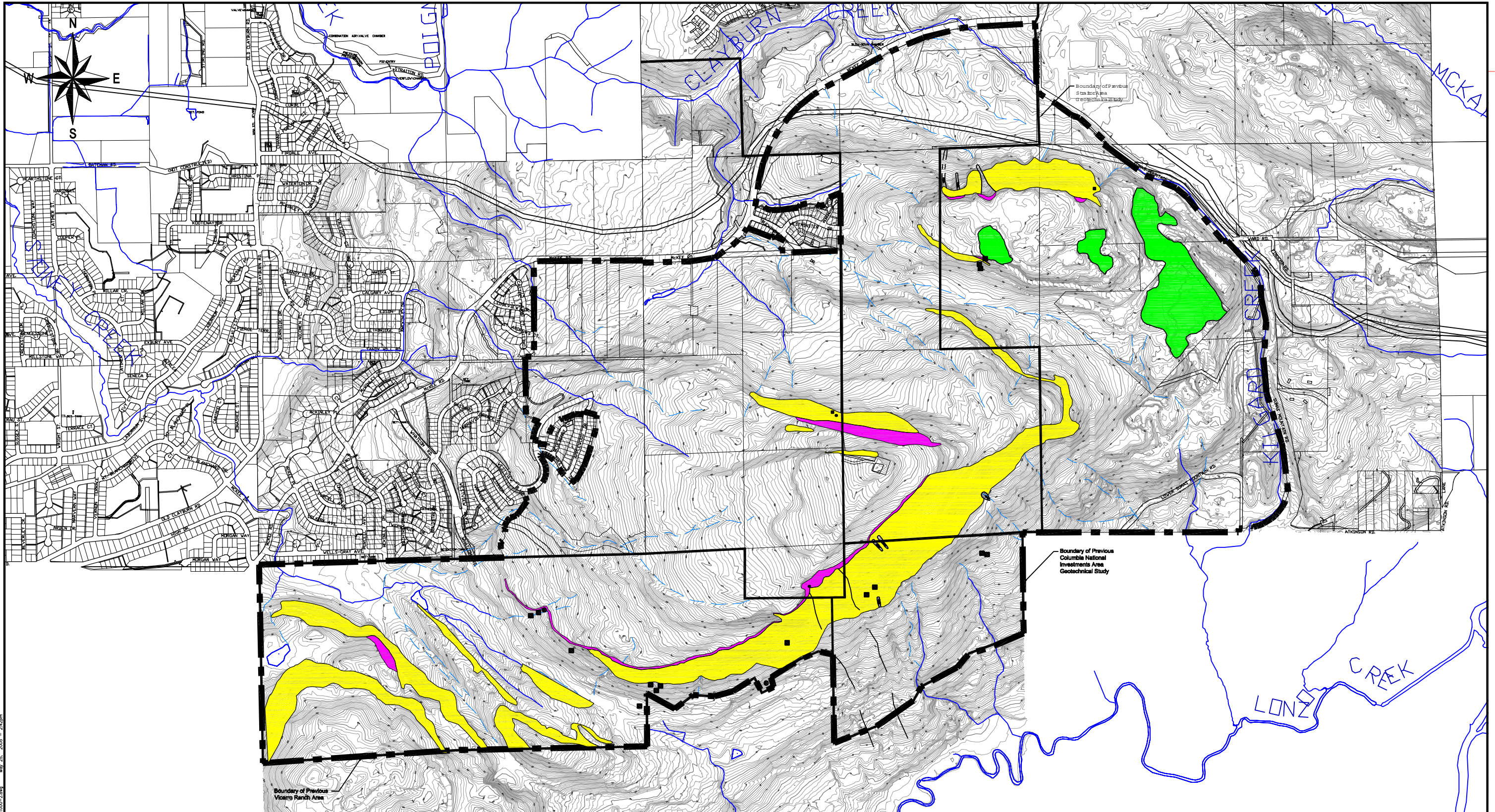
There are also historical accounts of two mudslides which occurred on the steep, southeast facing slope of McKee Peak in January, 1935. These slides, jointly referred to as the Kilgard Slide, were responsible for the destruction of the Clayburn clay products plant and the deaths of two individuals. The larger of the two slides initiated high up on the slope and was reported to have resulted from the failure of fine-grained colluvial material overlying steep slopes below the bedrock escarpment following a period of sustained intense precipitation.

#### 2.2.4 Summary

- Structure and composition of bedrock are the main factors that have influenced geomorphology and terrain and, accordingly, natural geotechnical hazards.
- Gentle dip slopes are appropriate for development provided there are suitable setbacks from the edges of bedrock escarpments. Detailed geotechnical study is recommended to determine specific setbacks in escarpment areas where cross jointing and/or undermining occurs. In addition, surface water should be managed so that the stability of adjacent steeper terrain is not compromised (i.e. the annual probability for occurrence of debris slides does not increase).
- A large rockslide feature occurs within the project area. The likelihood of another such failure is considered to be low to moderate and should not significantly influence development.
- The hazard from fragmental rockfall is considered to be high downslope from steep bedrock slopes that occur throughout the project area; however, we consider that risk can be adequately mitigated by restricting development to areas beyond the projected rockfall shadow limit.
- The hazard from debris slides is considered to be high on and at the toe of steep slopes. Further investigation is recommended to determine potential runout distances and establish appropriate setbacks from the base and crest of slopes.
- For areas underlain by eolian soils, prior to construction this material should be sub excavated to reduce the seismic hazard to residential structures. Reconstruction to grade using properly placed and compacted structural granular fill may be required. We recommend that foundations be inspected by qualified geotechnical personnel to confirm suitability of the subgrade and to provide additional recommendations if required.

Provided that development is carried out in accordance with the above recommendations, there are no major geotechnical impediments to development and much of the project area can be safely developed for residential use. Figure 4 – Geotechnical Characteristics offers a summary of geotechnical characteristics in the study area.



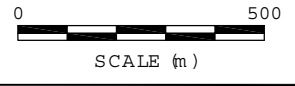


**LEGEND**

	Bedrock escarpment/steep bedrock slope with rockfall debris slide initiation potential		Boundary of debris slide track
	Moderately steep to steep slope with debris slide initiation potential		Boundary of rockfall track
	Open pit mine		Fracture entrenchment (1:100:1)
			Overhang/Cave status

**REFERENCES**

1. JUMA ENGINEERING, CAD Files: D10, D11, D12, E11, E13, F12, F13, D1015, E1015, F1015 and Hydrology, Date Received: December 15, 2004.
2. JUMA ENGINEERING, CAD Files: McKeePeak study by.dwg, Date Received: January 14, 2005.



PROJECT		CITY OF ABBOTSFORD MCKEE PEAK PLANNING STUDY ABBOTSFORD, BC			
TITLE		GEOTECHNICAL CHARACTERISTICS			
 Golder Associates OFFICE_PROV/STATE	PROJECT No.	PROJECT_NO	FILE No.	FILE_NO	
	DESIGN	DESIGN	DES_DATE	SCALE	SCALE REV. REV
	CADD	CADD	CAD_DATE		
	CHECK	CHECK	CHK_DATE		
	REVIEW	REVIEW	RVW_DATE		
Figure 4					

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## 2.3 Mining

Mining activity on Sumas Mountain is generally considered to have started in 1905, and continues to this day. However, there are references to earlier, small scale mining activity within the McKee Peak study area dating back to 1887. The exact location of some of these mining sites, particularly the locations of underground mine workings, is not known with a great deal of accuracy.

Mining records from the MINFILE database, maintained by the BC Ministry of Energy and Mines were reviewed, but revealed only three mines within the study area, all of them close to Sumas Mountain Road, along the east boundary of the study area, and within the current Sumas Shale Ltd. mine property.

The most valuable information on historic mining activity was provided by local mining historian, Mr. Chris Holbrok, who provided information on the approximate location of thirteen different mines within or close to the study area, as well as other anecdotal information on the possible location of further mining activity.

Information on areas of mining activity is depicted on Figure 2.

The eastern edge of the study area is the location of the most extensive current and historical clay mining activity. In some cases, a number of mines are located on the same legal property. Historically, eight mines were located in this area, and include the Fireclay Mine, New Fireclay Mine, Red Shale Mine, Richmond Mine, No. 5 Mine, No. 8 Mine, No. 9 Mine, and the 4B Mine. Historic mining activity tended to be concentrated on either side of Lower Sumas Mountain Road within a few hundred metres west of Kilgard Creek. This entire area is now mined by Sumas Shale Ltd., who have produced a 25 Year Mine and Reclamation Plan (1996), as well as a land use plan following mining (Nov, 2004). It is understood that mining and quarrying in this area may have another 30 to 50 year lifespan.

The extent of historic mines is unknown, and written records and maps of the mines may no longer be available. It is also unclear as to whether all of the mining activity within the study area has been identified.

## 2.4 Archaeological and Cultural Resources

There have been only limited archaeological investigations in the past, and there are no recorded archaeological sites within the study area boundaries.

According to data obtained from the Sto:lo Nation there is evidence of family areas, aboriginal trails, local place names and landscape features.

Only sites that are protected under the Heritage Conservation Act are legally to be avoided by development. As part of this project the Sumas and Tsawwassen First Nations were contacted. A meeting was also held between Golder Associates and the Sto:lo nation archaeologist to discuss the nature of the planning project. The consultants received a Sto:lo Nation Heritage Investigation Permit, and some GIS archaeological potential model data.

The Sto:lo people adopted a cyclic lifestyle utilizing specific resources as they became seasonably available. During winter months families spent much of their time indoors subsisting off preserved foods gathered during the warmer times of the year. Winter houses consisted of circular or rectilinear and semi-subterranean pit houses covered with dirt accommodating between 15 and 30 people. Hunting, fishing, and gathering of plants provided food.

A total of ten Halq'emelem place names and landscape features occur in and near the study area. The names document both geographic locations and the story of the great flood which occurred sometime in the distant past. The presence of 'Thunderbird Caves' indicates that these are features inhabited by Thunderbird, a central figure in Coast Salish identify. Sumas Mountain is considered a highly spiritual landscape feature.

There is a high likelihood of archaeological sites occurring within the study area. This is based on the presence of traditional and contemporary family use sites and trails.

More information can be documented through a Traditional Use Study, an Archaeological Impact Assessment and Heritage Resource Impact Assessment. This will aid in directing development activity from conflict with cultural heritage resources, and will provide an opportunity for more detailed management recommendations. (Further background details are included in the binder Technical Background Material, February 2005.)

# Part Two – Developing the Concept Plan

## 3.0 Concept Planning Considerations

The development of potential planning options related to a review of the McKee Peak landscape, overall market conditions influencing land use in the area, and consideration of feasible options on the basis of the earlier biophysical analysis (as summarized in Parts 1 and 2). This section examines the visual landscape and market conditions and in conjunction with earlier developed data, provides the foundation of the concept options which are summarized in the next chapter.

### 3.1 Landscape Analysis

Success of the McKee Peak Planning Study will depend on appropriate consideration of visual and recreational characteristics of McKee Peak. To provide this consideration, UMA completed a visual analysis of the study area. Three viewpoints surrounding McKee Peak were prescribed in the terms of reference; three additional viewpoints have been added by UMA to provide a more complete survey of the visually important areas of the site. The work to date identifies areas considered to be important for retention if visual quality objectives are to be met.

#### 3.1.1 Definition of Visual Quality Objective

The community and region has expectations that the Peak not be developed without regard for visual and landscape quality. Because the study area is largely in private ownership, and is currently designated for development, simple retention of large areas is not a realistic option. It was therefore decided to initiate an examination of the Peak to assess visual sensitivity in conjunction with the recreation demands on the area, and the landscape and environmental inventory. This allows for visually important areas to be identified in relation to other natural and environmental attributes.

The visual landscape quality objective for the McKee Peak Planning Study is to identify areas of the site that are important to preserve in their natural state in order to maintain a sense that development continues as a community within a natural forest. This will support a desirable community character, and aid in protecting the rural landscape of Abbotsford.

#### 3.1.2 Process

The City identified three locations around the study area to be used as analysis viewpoints. These are:

1. Highway 1, east of Whatcom Road, looking north
2. Highway 11 at Clayburn Road, looking southeast
3. City Hall, looking east

As the field work associated with this task proceeded a decision was made to add three additional viewpoints to the visual analysis. These are:

4. The Auguston development, looking southeast
5. The end of Whatcom Road, at the Hydro R.O.W along the previously proposed connection route, looking southeast

## 6. McKee Road at the Hydro R.O.W looking northeast

These added locations are also important for views to the study area. They are near-field locations, and are of importance to current and future residents of the Peak and the surrounding residential areas.

Areas identified as important contributors to visual quality were also examined in relation to potential trail routes and known viewpoints within the study area. Some current mountain recreational uses (e.g. mountain biking) are unauthorized, and occur without land owners' permission.

Land cover polygons and wildlife locations, mapped separately as part of the environmental analysis, have been considered in the mapping of visual sensitivity polygons. These factors did not influence the initial selection of visually important areas, but are factored into the summary of landscape areas to be preserved.

### 3.1.3 Methods

The six viewpoints were visited and photographed. These photographs were enlarged and stitched together to form panoramas of the site and surrounding area. The six viewpoint photo panoramas were then evaluated for visual importance, based on several variables:

- topography
- unique or notable landforms
- distinctive forest cover
- ridgelines and profile areas

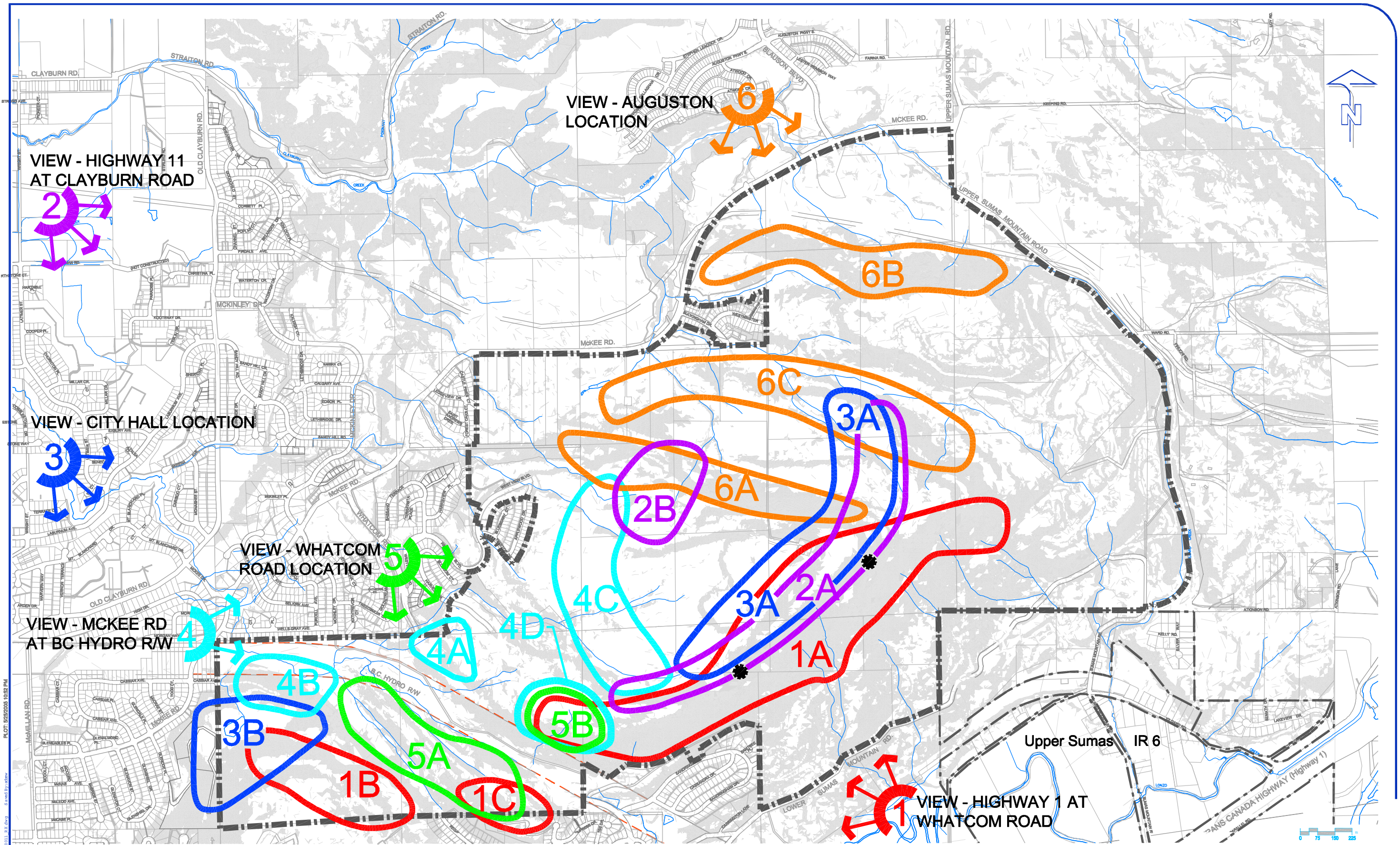
In addition, the visual proximity to surrounding landscape elements was considered. For example, snow-covered mountains east of the valley are visible from the City Hall area, and this was considered to add sensitivity to some areas of McKee Peak, which is seen as foreground to the mountains behind.

The areas of visual importance were then transferred to a topographic plan of the site. The site areas considered to be most important from each viewpoint were delineated in approximate form on the topographic plan, coordinated with each of the viewpoint locations.

The visual analysis inventory findings are summarized on Figure 5 – Visual Analysis. Prime view polygons are colour coded and numbered to reflect their respective view points as identified on the map. Some of the view sites are located off the map sheet, but their approximate location (e.g. City Hall) has been identified and noted as appropriate. In several cases polygons overlap, as the ridge lines are visible from multiple view point areas.

Once polygons were mapped preliminary consideration was given to current and potential recreational opportunities and their possible relation to the visual analysis polygons. For example hiking and mountain bike trails may be included in future park or forested areas, and may also be important from the perspective of view protection. Several notable viewpoints near the top of the peak, facing south, have been identified, and are noted on the visual analysis map. The opportunity thus exists to focus site planning on preservation of visual analysis polygons that serve as a means of protecting view corridors, while achieving other recreational and/or environmental benefits.





SLOPES OVER 30%  
 PEAK VIEW POINTS

**NOTE:**  
 The color of the viewscape polygons is identical to the color of the viewsite locations. Several view locations are identified schematically, as actual locations cannot be illustrated on this map.

Figure 5: VISUAL ANALYSIS





### 3.1.4 Rating the Viewpoints

The following provides a synopsis of each of the respective view points (noting those that were requested by the City) examined as part of this project.

#### *Viewpoint 1. Highway 1 East of Whatcom Road (City request)*

Views to the north to the site are focused on the cliffs and westward sloping ridge line of the peak. Forest cover from the ridge to below the cliffs and the cliffs themselves are seen as unique features, and as a result are critical to the character of McKee Peak. Views are relatively close, and landscape/ ground detail is apparent from the viewpoint

#### *Viewpoint 2. Highway 11 at Clayburn Road (City request)*

This area has wide, relatively unencumbered views of the peak. Any further development on the peak will affect views from this location. This viewpoint is the farthest from the site of the six viewpoints examined, and this lessens the immediacy of hillside development. The north side of the cliff top ridge and the north-western shoulder of McKee Peak are most important when viewed from Highway 11 at Clayburn Road.

#### *Viewpoint 3. City Hall (City request)*

Views of the peak are generally obscured by buildings, and partial views, rather than of the entire area, predominate. The peak is at a middle distance, and intermediate elevations of the study area are as important as other areas. The cliff ridge, however, is important to views from this area as well.

#### *Viewpoint 4. McKee Road at Hydro R.O.W. (added by UMA)*

At this point, the views of the peak open up to vehicles traveling northeast along McKee Road. Near-field views to the north side of Eagle Mountain, and the south-western edge of the Hydro R.O.W are anticipated to be important to views from this location. Important, but less critical, is the south facing higher elevation slope, in a band extending northward and approaching the peak.

#### *Viewpoint 5. Whatcom Road at Hydro R.O.W., End of Constructed Road (added by UMA)*

As Whatcom Road becomes an increasingly important access point for future residential development, views from this road area have been added to the work. The northeast slopes, facing the Hydro R.O.W and the ridges beyond are immediate, near-field views.

#### *Viewpoint 6. Auguston Community (added by UMA)*

As a growing residential area, and on slightly elevated land, views to the site will be shared by future residential development to the northwest of McKee Peak. The steeper slopes which occur in generally horizontal bands form benches important to all views from the northern quadrants. Although not critical for the Highway 11 at Clayburn Road location (point 2), these sloped areas benefit views from that location as well.

### 3.1.5 Viewscape Conclusions

The analysis and assessment to date indicate that the south-eastern facing cliffs and the ridge line above it are the core of the area most worthy of protection to achieve the visual quality objectives. In addition, portions of the land on either side of the Hydro R.O.W and the steep curving, horizontal slopes on the north and northwest faces are expected to make a significant contribution to preserving a sense of natural environment when seen from the surrounding areas.

Through the use of overlays it is apparent that visually important areas coincide in large measure with areas important for other criteria (e.g. the southern cliffs and the vegetation above and below are important for wildlife). Although general, some of the steep north-western slopes (see viewpoint 6 above) are in proximity



to areas where watercourses and Pacific Water Shrew management and assessment areas may make preservation of land serve visual as well as environmental needs. As seen on Figure 5 the visual sensitivity polygons are numbered to correspond with the numbers of the viewpoints, and the letter indicates the importance ranking for each polygon; A being the most important. Overall, the most critical area is polygon 1A, including vegetation above and below the cliff. This area is critical for views from many surrounding locations, and includes the most important close range views, some important habitat, and the cliff geologic feature.

Riparian setbacks tend to run vertically and do not, by themselves, provide effective visual benefits. At McKee Peak, the frequent correspondence between visually important areas, locations significant for wildlife and topographically challenging or unique areas should aid in achieving a desirable visual quality for the study area.

## 3.2 Land Use and Market Considerations

This section reviews current land ownership in the study area, and offers a summary of market conditions and market influences with respect to McKee Peak (based on data and analysis carried out in early 2005). It is based on quantitative data from existing market information sources including CMHC, MLS data, and lot price lists from currently marketing developments, and discussions with local realtors, developers, and land owners. A brief commentary on the planning implications of anticipated residential and commercial development is also provided.

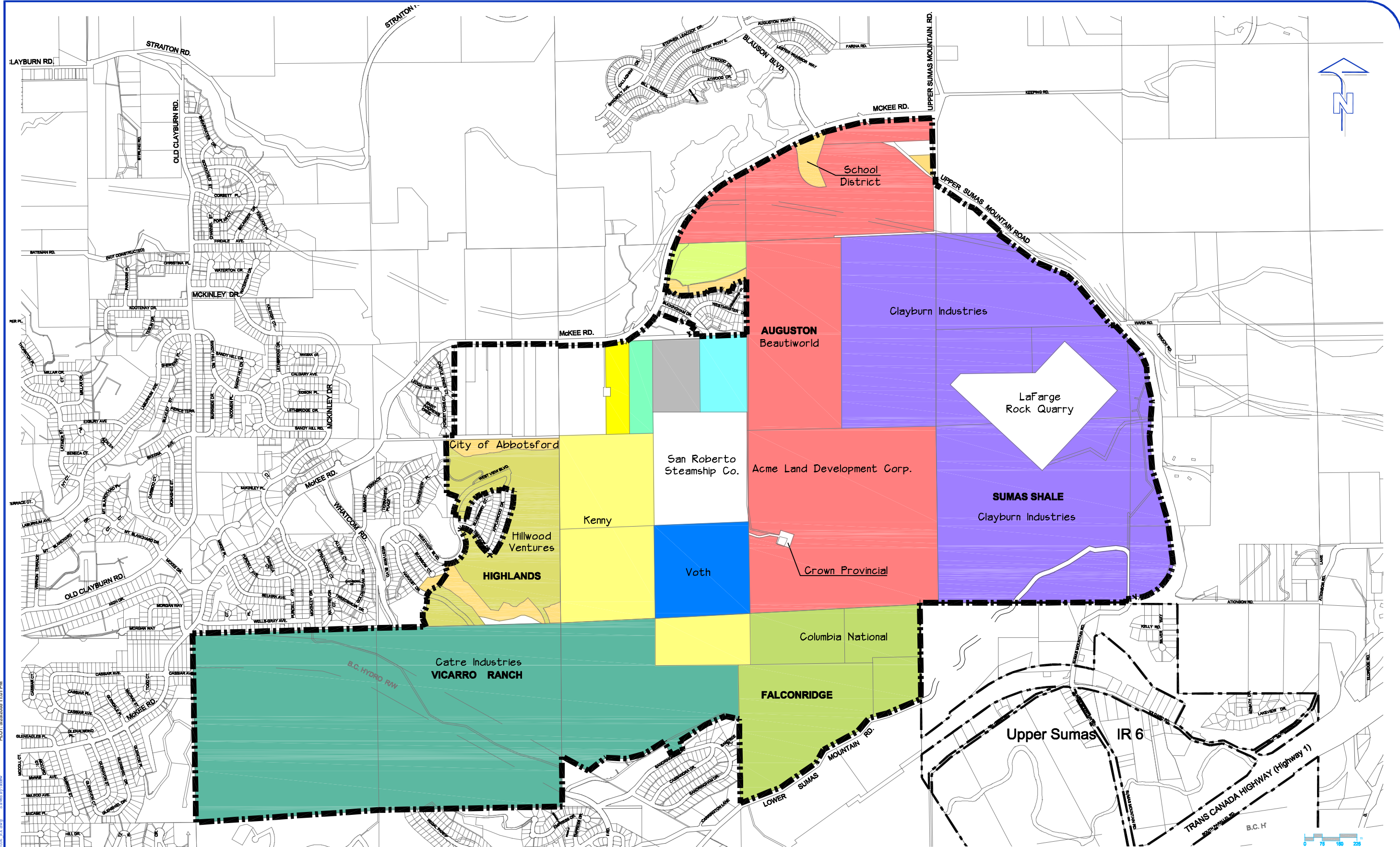
### 3.2.1 Land Ownership

While many areas of the city are fragmented into small parcels with broadly diversified ownership, McKee Peak in contrast is held in larger parcels and by relatively few owners. Several owners are actively developing their property; others have been long term land owners and seek guidance from the McKee Peak Plan as a means of directing their long term land use activities. Overall ownership, as of mid year 2005, is illustrated by Figure 6 - Ownership.

### 3.2.2 Single-Family Detached

The limited supply and the increased demand created by factors such as strong population growth and historically low interest rates has resulted in dramatic increases in new home prices, as recorded by CMHC. According to MLS sales data, which includes both new and resale product, the price of a typical single family home has risen by over 50% over the last five-year period, among the leaders in the Fraser Valley. From 1998 to 2004, annual absorption of new single family dwellings in Abbotsford has averaged 329 per year, or 27 homes per month. During this period, this ranged from a low of 289 units in 2000 to a high of 379 units in 2002.

View properties in the Sumas Mountain area are indicative of the potential values for many of the planned single-family lots at McKee Peak. Available single-family lots at “Jade Canyon” on Eagle Mountain, range from as low as \$169,000 (445 m<sup>2</sup> or 4,801 sq. ft.) to as high as \$450,000 for an “estate”-sized lot of over 3250 m<sup>2</sup> (35,000 sq. ft) (all data is as of early 2005). Smaller lots along Goodbrand Drive and “upper” Jade Drive, which offer less substantial views, range in price from \$169,000 to \$230,000. Larger lots with significantly better views, located along “lower” Jade Drive and Eagle Mountain Drive, are priced between \$250,000 and \$425,000.



**LAND OWNERS**












- |   |                       |   |                         |
|---|-----------------------|---|-------------------------|
|  | CLAYBURN INDUSTRIES   |  | JOHN VOTH               |
|  | COLUMBIA NATIONAL     |  | FERNCO DEVELOPMENT      |
|  | ACME LAND DEVELOPMENT |  | MALCOLM VENIER          |
|  | CATRE INDUSTRIES      |  | JACOBS                  |
|  | CITY OF ABBOTSFORD    |  | FRASER CITY INVESTORS   |
|  | HILLWOOD VENTURES     |  | RETIRE WEST COMMUNITIES |
|  | GEORGE KENNY          |   |                         |

Figure 6: OWNERSHIP

PLOT: 3/25/2005 11:01 PM  
 1995-01-01 08:42:01 AM  
 © 2005 City of Abbotsford



### 3.2.3 Row Housing (Townhouses)

From 1998 to 2004, absorption of new townhouses averaged only 39 units per year or 3 per month. Activity in recent years has increased by a significant margin to 70 units in 2003 (6 units per month) and 61 units in 2004 (5 units per month). The Abbotsford market has exhibited stronger multi-family market activity in past periods, such as 1992-1997, which indicates that activity in this product segment is likely to increase when conditions are right.

Townhouses (3 bedroom) median sale prices have tended to hover in the \$230,000 to \$240,000 range since 1998. The larger, higher-end townhome units of Kingma Development's Forest Ridge at Carrington (south of McKee Peak on Sumas Mountain) began selling in late 2002/early 2003 at price points as low as \$268,000, but more recently have sold at price points ranging from \$280,000 to \$302,000 (2005 data).

MLS data, which includes both new and resale product, indicates that the price of a typical townhouse has increased by more than 47% over the last five years (to 2005) – roughly comparable to the average increase in single family dwelling values.

### 3.2.4 Apartment Activity

Overall apartment absorption averaged 115 units annually between 1998 and 2004; this included a significant portion of apartment rental (36%) and non-profit apartments (16%). The apartment condominium (ownership) market, which is relevant to the planning area, accounted for only 48% of overall apartment absorption, or an average of 56 units per year (under 5 units per month).

At the close of 1998 and 1999, apartment condo inventory stood at 172 units and 141 units, respectively, equating to well over 30 months worth of supply at a period average absorption of 5 units per month.

New apartment sales in Abbotsford over the 1998 to 2004 period have been low relative to the previous decade, which has resulted in very limited sale price data through CMHC. Values for apartments have climbed considerably over the last several years. Proximity to planned commercial nodes is deemed key to the successful marketing of such projects. The sale price of a typical apartment in Abbotsford has risen by over 60% during the period 2000 - 2005.

### 3.2.5 McKee Peak Market Prospects

Buyers in the Auguston area (north of McKee Road) have tended to be 80% younger working families, 20% older pre-retirement and retired couples and singles. Roughly 50% to 60% of younger working families have children.

Other developers report a mix of 75% families (most with children) and 25% older couples and retirees, with the vast majority (80% to 85%) coming from Abbotsford.

A suggested probable product mix is based on a composite assessment of the following:

#### Historical Absorption – City of Abbotsford

Over the 1998 to 2004 period, absorption for the major housing product types was as follows:

**Table 3-1 - Absorption of Major Housing Product Types – 1998 to 2004**

Product Type	Annual Unit Absorption	% of Total (these categories)
Single-Family	329	78%
Row Housing (Townhome)	39	9%
Apartment Condominium*	55	13%

\* Net of rental apartment and non-profit apartment construction

Single-family units accounted for 78% of all unit absorption in these three major product categories over the 1998 to 2004 period, which is indicative of the high proportion of families (most with children) seeking homes in Abbotsford. This proportion has been corroborated by area developers. There is no reason why this proportion should not hold for the McKee Peak area, which is why 70% to 80% of all units are recommended for either conventional/large lot or small-lot single family. A small-lot single-family component has been included largely on the basis of success in the Auguston development and for the purposes of increasing the overall level of single-family affordability.

The proportion of townhomes (5 to 7%) is deemed achievable based on the area’s view potential, assumed high quality development, and the inclusion of at least one or more small commercial nodes which will serve a local, convenience-oriented function.

A significantly smaller than city-wide proportion of apartments (2% to 3% vs. 13%) results from the fact that the vast majority of saleable apartment product in Abbotsford occupies more easily accessible and amenity-rich locations relative to McKee Peak. A small proportion of apartments will nevertheless be appropriate for McKee Peak, particularly for meeting the needs of buyers requiring less living space, such as retirees.

Bare land strata has been included in order to allow for development of detached dwellings where municipal standard roadways are not realistic and to provide for another level of affordability in detached product.

Based on a high level review of market conditions, the possible product mix from a market perspective for the McKee Peak area, at least over the short term, might generally be listed as follows:

- Conventional Single Family: 60% to 65% (lots 500 sq. metres or greater)
- Small-Lot Single Family: 10% to 15% (325 to 475 sq. metres – in flatter areas)
- Bare Land Strata: 10% to 15% (strata-titled detached units)
- Townhomes: 5% to 7% (mostly main floor master suites)
- Apartments: 2% to 3% (high quality, views, close to services)

For long term planning, the above percentages are expected to shift gradually, resulting in increased proportions of townhouse and apartment product relative to the larger single family segment. Therefore, once build-out has been achieved, the overall proportion of conventional single-family development is expected to be lower than that stated above.

Single-family homes are expected to be the first choice at McKee Peak. Inclusion of a quality secondary suite (finished daylight basement) is a vital consideration as it has a significant impact on affordability.

Where site access may be more problematic, bare land strata developments may provide the next best potential product, as it provides home owners with private detached units and yards, and commonly shared and maintained roads.



For townhouses, the primary market is older couples and singles of pre-retirement or retirement age with a preference for main level master suite home designs. Additional guest bedrooms may be on another level. Due to cost considerations and the quality of potential views at McKee Peak locations, higher end townhomes (\$300,000 and up) are likely required at McKee Peak due to the economics of steep slope development costs. The size of the market for higher-end townhomes at McKee Peak is, however, deemed to be relatively small.

### 3.2.6 Development, Lot and Design Configurations

Single-family buyers, particularly those with children, demand sufficient lot depth to provide a decent sized rear yard. A substantial rear yard is also prized by families without children, who tend to have pets (particularly dogs) and who have an active interest in gardening. The market appears to indicate resistance to lot depths of less than 30 metres (in the case of small lots) and less than 32 to 36 metres in the case of more conventionally sized lots. Eighteen metre-wide (60 foot-wide) lots have proven more desirable than 15 metre-wide (50 foot-wide) lots, however buyers have been unwilling to pay more than a threshold increment of roughly \$10,000 for this additional lot area, in spite of the increased home design options such lots afford.

Lots with greater frontage (and thus views) are desired by those who can afford higher price points, but these buyers will nevertheless demand sufficient lot depth to provide a sizeable rear yard according to market experience.

There is some market resistance to “upslope” staircase designs, as the level entry, walk-down basement home designs available on “downslope” lots are generally preferred. For example, younger families with children are showing a preference for downslope homes with full basement suites, which can yield substantial rents which then offset the cost of the mortgage. Abbotsford’s secondary suite policy thus serves to increase the affordability of otherwise unattainable housing.

### 3.2.7 Commercial Land Use Recommendations

Two planned commercial nodes in the vicinity of the McKee Peak study area, namely the “main-street”-oriented node in the Auguston area and the neighbourhood commercial site at the intersection of McKee Road and Whatcom Road, will serve the basic day-to-day shopping needs of the local McKee Peak residential population. While not technically within the study area, these sites occupy important gateway or intercept locations. An additional small retail-commercial node may also be appropriate in the vicinity of the golf course, where some properties offer significant redevelopment potential.

It is inadvisable to consider a sizeable commercial node in an internalized McKee Peak location (i.e. not on a high exposure perimeter location such as McKee Peak Road). Smaller, micro-commercial nodes in McKee Peak study area locations may be provided for so long as they are:

- located in high exposure locations along major internal McKee Peak roads, preferably at the intersections of two major roads;
- at most about 0.5 ha (1 to 1.5 acres) in size, but preferably smaller so as not to negatively affect the larger proposed commercial nodes in locations just outside
- intended to accommodate purely convenience-oriented resident daily shopping and service needs
- within realistic walking or cycling distance of a sufficient number of local residents to ensure their long-term sustainability

Inclusion of such micro commercial nodes at appropriately well exposed internal McKee Peak locations will provide a degree of walkability without adversely affecting the viability of larger commercial nodes in the area.

The potential commercial node near the Ledgeview Golf Course is not envisioned as being competitive with the planned primary commercial centres at either Auguston Town Centre or at McKee and Whatcom Road. Rather, this potential node may accommodate a small range of specialty and recreational commercial uses which complement and build upon a potentially redeveloped golf course facility (i.e. semi-private tennis club, squash and racquetball facilities, health and fitness centre/spa, etc.)

# 4.0 Option Development

## 4.1 Introduction

As part of the project, and before selecting a preferred plan a number of planning options were developed. The consultant team noted that the physical conditions of the site, and the relatively limited amount of developable land constrained the overall ability to arrive at significant distinctions between the options. However several alternatives were developed. Each is cognizant of biophysical features, environmental constraints, and landscape and market considerations but responds in a different manner to the degree and emphasis on these factors.

## 4.2 Planning Principles and Options

A number of considerations influenced the generation of these preliminary plans. A major element included development of broad principles intended to be fundamental to each option, and which were reviewed with the public at one of the presentation meetings. These principles are summarized as:

- Avoid development on severe terrain and respect environmental characteristics; retain some areas as natural space
- Control erosion, production and transport of sediment
- Protect streams, natural hydrology, and riparian habitat by minimizing stream crossings
- Ensure provision of a major community park at McKee Peak supplemented by neighbourhood level parks appropriate to the area and commensurate with projected population
- Minimize the loss of natural vistas
- Define visible hillside ridgelines and keep these free from development
- Make provision for suitable scaled low intensity commercial, institutional and civic land uses sufficient in size to serve the contributing market area
- Provide a network of interconnecting streets designed to reduce speed, provide effective routing for transit and accommodate pedestrian movement
- Utilize residential clusters or enclaves as a means of preserving natural terrain and vegetation and to protect environmentally sensitive habitat
- Provide a variety of interconnected parks, open spaces, and recreational trails to meet the needs of residents and outdoor recreation participants, and achieve this in the form of an integrated green space system

Using the above principles three land use options were developed. Each of the three options was designed to accommodate appropriate setbacks and nature preservation areas. Road links are provided to connect the various development nodes. Major commercial activity is not expected to occur in the study area, but as a means of promoting sustainable land use and to minimize vehicle travel, provision is made for local convenience commercial needs. The potential mix of housing varies with each option, but encouragement is to be given to ensure a broad variety of housing, and a scale of development that does not detract from the views of the Peak area. The option maps are found in the Appendix.

### Option A – Description

Follows recommended best management environmental practices without deviation. This includes aquatic and wildlife setbacks consistent with preferred Best Management Practices (including desired setbacks for raptor nests), incorporates retention of all steep slopes over 30%; provides for full preservation of Pacific Water Shrew habitat setbacks.

### Option B – Description

Retain desired setback areas but recognize some potential variation based on more detailed environmental studies. Observe some setbacks as management areas, which may or may not be retained if detailed studies suggest that some development is acceptable. Permit more development in steeper slope areas, with provision for select residential development in slopes up to 50%.

### Option C – Description

A variation of the previous options with best management practices to be followed. Includes provision for development in some riparian areas where proven environmentally acceptable. Some steeper slope development is to be allowed, but any residential between slopes of 30 to 40% is to be limited to cluster or multiple family housing. Slopes greater than 40% are to remain undisturbed.

Following further review Option C ultimately formed the basis for the preferred option. Table 4-1 below summarizes the principal characteristics and approximate housing and population yields. It should be noted that each option has very different assumptions about the relative proportion of single family housing to total housing. Option A assumes 60% of the housing as single family (SF) housing, Option B assumes SF at 90%, and Option C at 70%. The balance is noted as multi-family and/or cluster housing (designated MF). The City currently has about 60% of all of its housing as single family housing.

**Table 4-1 - Principal Characteristics and Approximate Housing and Population Yields**

Characteristics	Option A	Option B	Option C
<b>Total Green Area</b>	286 ha (707 ac)	238 ha (588 ac)	252 ha (623 ac)
<b>Developable Max. Slope</b>	No development on slope >30%	Avoid slopes > 50%	Any areas above 30% (but below 40%) is limited to multi-family and/or cluster housing
<b>Developable Area (Data is approximate)</b>	285 ha (42% of site) (704 ac)	430 ha (63% of site) (1,063 ac)	425 ha (63% of site) (1,050 ac)
<b>Assumed Housing Mix</b>	SF = 60% MF = 40%	SF = 90% MF = 10%	SF = 70% MF = 30%
<b>Total Units (mix as above)</b>	SF - 1705 MF - 1140	SF - 3590 MF - 400	SF - 2940 MF - 1280
<b>Projected Population</b>	8,925 persons	13,300 persons	13,270 persons



# Part Three - The Concept Plan

# 5.0 Concept Plan Land Use Characteristics

## 5.1 Introduction

The genesis for the preferred land use plan was provided by the initial three options. The preferred plan reflected additional technical analysis, refinement of development densities, further clarity to the location of the proposed City park, and additional consideration of road linkages and topographic constraints.

This section outlines the major objectives inherent in the final land use concept, summarizes the main features and defines the extent of projected development. This section is then followed with a chapter that reviews transportation issues and proposals, which is in turn followed by a chapter on utility issues. The actual plan policies and recommendations are included in the last chapter of this document. This allows the City to utilize the final chapter of this report as a 'stand alone' section offering the basis for possible inclusion of the McKee Peak Plan within the Official Community Plan.

## 5.2 Objectives

The preferred land use concept for the project area gives consideration to the following major objectives:

- Recognize area environmental and slope conditions and provide for development that is financially responsible;
- Maintain the critical green spaces on McKee Peak. These may be either environmentally important, or represent critical landscape units that maintain the aesthetic quality of the hillside;
- Ensure that the limited developable land base is optimized, and capitalizes on the physical site features of the area;
- Provide for a good size City Park at the Peak area, retaining its natural environment but allow for trail access and connectivity to other green areas on the hillside and to areas beyond the study boundaries;
- Allow for innovative forms of development, but ensure an appropriate proportion of multiple family and/or cluster housing as a means of retaining open space, and also as a method of reducing per unit servicing costs; and
- Encourage environmentally friendly roads and utility services that have low overall impacts.

By adhering to these goals, the City can achieve a reasonable land use pattern that continues to respect the environmental qualities of the hillside, providing for development that can absorb the relatively greater cost associated with creating buildings and structures on challenging slopes.

## 5.3 Land Use Concept, Overview

### ***Plan Vision***

The vision associated with the land use concept for McKee Peak proposes a series of development enclaves which comprise several cluster neighbourhoods bounded by significant green spaces (bluffs or riparian areas). The neighbourhoods provide a mix of housing types with nodes of multiple family housing generally associated with steeper areas, and an excellent trail network connecting all the major areas and linking to attractions beyond McKee Peak. A series of small neighbourhood parks provide for active

recreation space, and where feasible are combined with elementary school sites and the village commercial centre to create activity nodes and focal points. A major trail extends along the principal south facing bluffs offering several outstanding view points and linking to a sizable and largely natural city park. Steep slopes and riparian areas are protected from development, thus retaining substantial amounts of green space, and providing and protecting wildlife and vegetation. An emphasis on appropriate servicing standards such as reduced paved road widths and attention to the retention of vegetation to support storm water infiltration can enhance the overall environmental sustainability of the McKee Peak community.

### ***Plan Features***

The land use concept for McKee Peak supports a variety of development forms, but continues to retain a substantial extent of land with high wildlife and vegetation values, or posing significant slope and geotechnical issues. All of the mapped streams retain their designation as assessment areas for which more detailed environmental analysis may be required to support proposed setbacks, or reduce or expand them. It is thus recognized that boundaries for riparian areas illustrated on the map may change on the basis of further field truthing and environmental study. Steep bluffs, including areas over 30% are generally open to development only if land uses exceed densities associated with single family housing, and furthermore encroachment of slopes in excess of 40% grade is not permitted. By protecting the steep bluffs, concurrent protection is achieved of the more critical wildlife and landscape units.

The land use concept makes a special allowance for creation of a green belt in a north/south orientation designed primarily to protect vistas for people situated west of the study area, and to offer green space connectivity.

The proposed city park encompasses approximately 24 hectares of land at the top of McKee Peak, and includes a connection west to protect raptor nests and several strategic view points. A system of major trails connects other portions of the study area, and in many cases coincides with important wildlife features, thus offering a critical network of connected greenways.

Housing for the concept plan is predicated on approximately 70% single family housing (with a variety of lot sizes), and 30% multiple family and cluster housing which will be the mandatory form of housing in areas where slopes over 30% predominate. The concept plan will provide for an estimated population of 13,000.

While the overall population is projected around 13,000 it is recognized that not all of this will be developed in the foreseeable future. Notable is the fact that approximately 25% of the developable area is contained in the Clayburn Industries and Sumas Shale property. Indications are that some of this area will be mined for a period as long as 30 to 50 years, suggesting very long term development of this portion of the area. The balance of the developable area at McKee Peak will thus accommodate around 9800 persons, with any land use over the Clayburn/Sumas Shale site to be conceived as very long term only. Nevertheless the connectivity of this area relative to the western portions of the site should be considered now, in order that planning can proceed in an integrated fashion.

Relevant plan policies and recommendations are included in the final section of this document.

## **5.4 Park/Green Space and Schools**

The study area will have a combination of greenbelts, a major city park, neighbourhood parks and trail links. The projected population for the project area has also permitted an estimate of school site requirements.

### ***Park Land***

One of the principal building blocks for the McKee Peak Plan has been the location of a major city destination park. As part of its long term park planning strategy the City has indicated an interest in acquiring a large natural park at the top of McKee Peak that would serve all city residents. The objective was for a park of around 25 hectares. Based on the land use plan most of the land above the 400 m

contour has been set aside for park purposes, with a narrower area adjacent to the bluff extending south to encompass panoramic view areas and to provide further protection for a Peregrine falcon nest along the bluff. Access will be from a proposed local road that connects downhill to the suggested extension of Westview Boulevard.

The acquisition of neighbourhood parks is driven by policies in the Abbotsford Park and Recreation Master Plan. This Plan suggests the development of combined neighbourhood/community parks on the basis of 2.4 hectares per 1000 population. (The ratio for neighbourhood parks only is assumed at 2.0 ha/1000 persons). For neighbourhood parks the Master Plan proposes that they be within 0.5 km of urban residents, and sites should be readily accessed. Assuming an ultimate population of about 13,000, approximately 26 hectares of park will be required. Neighbourhood parks are ideally around 2.5 to 3.5 hectares in area, and a service population of 2000 to 4000 (as noted in the OCP). However the relatively limited level areas at McKee Peak, suggest a more flexible park standard that allows for both larger neighbourhood parks, and a series of compact and smaller parks sufficient to serve the various development enclaves.

### **School Sites**

An estimate has been prepared for school requirements. The need for schools will ultimately be dependent on the demographic profile for the McKee Peak area, but for planning purposes several assumptions have been made. Based on an analysis of comparable areas, it is assumed that each household in the project area will have approximately .5 school age children. In addition it is assumed that not all of these children will necessarily attend schools within the study area, as there almost always is some 'leakage' to other areas. It is assumed that 90% of children in the study area would attend a school locally. On the assumption that the study area will have approximately 4000 housing units (at full development), there will be 2000 students (less 10%), for a total projected school age population of 1800. It is further assumed that 60% of the students will be elementary and 40% middle and secondary students. This thus produces the following enrolment projection at build out:

Elementary students	1080
Middle and Secondary students	720

Abbotsford has a preference for elementary schools with an occupancy of about 350 to 400 students, and a site area of 2 hectares. For a middle school, 600 enrolment capacity is assumed with a required site area of 3.4 hectares. For a secondary school the capacity is generally 1200 students with a site requirement of 5.6 hectares. Using these figures, McKee Peak will require 3 new elementary schools, and perhaps one middle school. Secondary enrolment would be accommodated outside the study area. There is available capacity in one nearby elementary school (Prince Charles Elementary), and if capacity continues to be available in the long term it may reduce elementary school requirements from 3 to 2 schools. For planning purposes a total of three school sites (of 2 hectares each) are identified on the land use concept map.

## **5.5 Residential**

The dominant form for housing on McKee Peak will be single family housing. However, given the relatively limited developable land base, every effort is to be made to achieve more concentrated forms of housing and multi family units. The ultimate desired mix is about 70% single family housing and 30% multi family housing or cluster housing. Cluster housing can consist of nodes of more intensively used residential land on sites that have features that are either undevelopable or that are to be preserved. The areas to be preserved allow densities to be transferred to the balance or more developable portion of the site. It is suggested that housing on slopes in the range of 30 to 40% be developed exclusively for multi-family or cluster housing.

For planning purposes single family parcels are expected to be largely in the 500 square metre range, but lots smaller than this, including parcels as small as 325 square metres should not be discouraged, especially since they permit optimization of the limited land base. Earlier market analysis suggests that the

preference for single family lot width is 18 metres, but policies allowing lots of 15 metres are suggested. Lot depths of about 30 metres allow for reasonable development sites as well as adequate land to be retained as landscaped areas, thus facilitating natural infiltration.

For multiple family housing building heights represent an important consideration, both in terms of accommodating adequate housing options, but also as it relates to the retention of view corridors. Such housing is appropriate for sites with steeper slopes (as a means of retaining open space), near parks and public amenities, and in proximity to major roads. For multiple family housing it is anticipated that most buildings would not exceed a height of 4 storeys. An exception is feasible for the area immediately across the Ledgeview golf course where the location on McKee Road and the enclave boundaries of nearby creeks create an area where higher density may be appropriate. This area is bounded on all sides by riparian or proposed park areas thus higher buildings will have limited impact on views from other residential areas. For this enclave a building height of 8 storeys maximum can be workable. It could conceivably include some ground floor commercial.

## 5.6 Commercial

Only a limited amount of commercial development is planned for McKee Peak. This largely reflects the fact that no major arterial roads will pass through the study area, although there are several collector roads. The prime commercial nodes are expected to be situated outside the study area at the Auguston Town Centre on McKee at Upper Sumas Mountain Road, and at McKee and Whatcom Road. It is anticipated that eventually there may be a further commercial node near the Ledgeview Golf Course.

There will be some opportunity for internal commercial development, but it is unlikely that local convenience uses could be supported until substantial population has been generated at McKee Peak. It is envisaged that a compact Village Commercial Centre (local convenience store, restaurant, medical services, etc.) will develop along a local collector road such as the east-west expansion of Westview Boulevard. Ideally a cluster of community development (neighbourhood park, school and retail area, including perhaps a community centre) will be focussed along or nearby this road, offering good access from many areas of the McKee community.

## 5.7 Land Use Development Data Summary

The detailed planning policies are contained in Section 8. The following provides a summary of key land use characteristics as embodied in the land use plan for McKee Peak. Relevant maps illustrating the plan are found at conclusion of Section 8.

**Table 5-1 – Summary of Key Land Use Characteristics**

Land Use	Characteristics	Comments
Residential	70% single family 30% multi-family	Lot Sizes: average 500m <sup>2</sup> , but as low as 325m <sup>2</sup> Building Height, 4 storey max. for MF housing, 8 storey max. south of McKee at Ledgeview
Neighbourhood parks	3 or 4 parks around 2 hectares supplemented with about 6 smaller parks around 1 hectare each	Park sites will vary with specific location and topography. Locate near schools where feasible
Schools	3 elementary (also a partial need for a middle school)	About 2 ha for elementary schools
Commercial	Likely one compact village centre on collector road, with site of about 3-4000 m <sup>2</sup>	Allow some potential near Ledgeview golf course, perhaps in mixed use development. Consider Village Centre in conjunction with a neighbourhood community / recreation centre

## 6.0 Transportation

### 6.1 Major Road Concept and Standards

This section considers transportation issues for the land use concept, including major roads, traffic impacts, suggested design of roads, and opportunities for multi-modal transportation. It also reviews transit considerations and projected traffic issues pertaining to the land use concept.

### 6.2 Prior Planning Influences

The City of Abbotsford has previously adopted, formally through City Council and informally through discussions with City staff, a number of neighbourhood and subdivision plans. Each of these plans offer proposed road lay-outs. These include The Highlands, Vicarro Ranch, Auguston and Falconridge. A Straiton Neighbourhood Plan, which includes Auguston, was adopted by the former District of Abbotsford prior to amalgamation with the District of Matsqui. Conceptual plans have also been prepared for the Clayburn Industries properties.

Due to concerns of the Sumas First Nation, the City of Abbotsford also established a conceptual alignment for a planned truck route, connecting Sumas Mountain Road at Ward Road to the Trans-Canada Highway # 1 at Atkinson Road. It is understood that for the first 10 years, this connection is limited to truck traffic only.

### 6.3 Major Planned Roads

#### 6.3.1 Arterial/Collector Roads

##### McKee Road

With the development of the Straiton Neighbourhood Plan McKee Road was extended from the Ledgeview Golf Course to Sumas Mountain Road in 1996. This arterial link provides direct access to the entire northeast quadrant of the City. It is planned as a 4 lane arterial road from its connection at Whatcom Road to Sumas Mountain Road. This plan does not contemplate any changes to McKee Road and its future expansion to 4 lanes.

A high level strategic review based on Option C of the major road network was conducted while preparing the McKee Peak Planning Study (refer to Table 4.1 – Principle Characteristics and Approximate Housing and Population Yields). Option C assumes a 70/30 housing mix, with the majority being single family development. The analysis concluded, in the long term, McKee Road will reach capacity with the development of McKee Peak using a typical growth rate of 2% for background traffic volume. Recent traffic counts have indicated a significantly higher percentage for background volumes, which could lead to capacity deficiencies in the peak direction. In addition other areas in the north-east sector, currently outside the urban development boundary, may be developed in the long term which could add to the congestion on McKee Road. Finally, if the actual housing mix contains a higher portion of single family homes (Option B), the capacity issues identified on McKee Road will become greater and be realized sooner.

Due to its relative importance in terms of providing access to the plan area, the Straiton Neighbourhood and lands beyond, it is important to carefully consider access to McKee Road as development applications are submitted for review. Every effort should be made to limit the number of local and private road connections to McKee Road. Locations in the Land Use Concept illustrate two new connections between Whatcom



Road and Sumas Mountain Road. The locations are conceptual and may change as development applications are received; however land owners along McKee Road will be required to jointly develop their lands over the long term.

### **Whatcom Road**

The Whatcom Road connection is an important link within the plan area. It will divert traffic from McKee Road west of Whatcom Road currently travelling through residential communities to the west. It is planned as a 4 lane arterial road connecting the northeast quadrant of the City to Highway # 1 and other parts of Abbotsford. Its alignment has been determined by the City and most of its funding has been secured within the DCC Bylaw.

### **Sumas Mountain Road**

Currently Sumas Mountain Road is a collector-type rural standard road following Kilgard Creek as it enters the Sumas Indian Reserve # 6. Recently the City decided to re-route truck traffic from passing through IR # 6 to a new connection off Atkinson Road and a new on-ramp at Highway # 1.

A portion of Lower Sumas Mountain Road passes through IR # 6. It is proposed that this road be shifted northerly to bypass First Nations lands and connect to the easterly extension of Westview Boulevard. Portions of this road may be difficult to construct within current engineering design standards due to steep terrain. Preliminary engineering design is required in order to optimize its alignment.

Upper Sumas Mountain Road between McKee Road and Ward Road will eventually be upgraded to an urban arterial road standard as development warrants its improvement, likely with the development of the Clayburn Industries reclaimed extraction site.

### **Westview Boulevard**

Westview Boulevard currently terminates within the Highlands Neighbourhood at the western edge of the plan area. The extension of Westview Boulevard to eventually connect to Sumas Mountain Road at Ward Road (realigned) provides for an important link. It is likely this connection may not be constructed within the next 20 years, as it dissects the current Clayburn Industries extraction site.

### **City-Wide Road Network**

Given the limited number of east-west arterial routes across the City, increases in traffic volumes generated from McKee Peak and other areas in the north-east sector, existing facilities such as Old Yale Road and South Fraser Way will become over saturated, generating the need for additional east-west capacity. This will be partially offset by the construction of the Hazel-McKee Connector; however, it may not be sufficient to handle peak volumes. Alternatives should be pursued. In addition, improvements to some Highway # 1 interchanges may be necessary.

#### **6.3.2 Local Roads**

##### **Buckingham Drive**

The extension of Buckingham Drive connecting to Westview Boulevard (extension) may form an important interim connection to McKee Road.

##### **Harvest Drive**

Harvest Drive is suggested as a loop through the Vicarro Ranch Neighbourhood to link Highlands and lands beyond.

## Ward Road

Ward Road located outside of, and adjacent to, the Plan Area currently intersects Upper Sumas Mountain Road at less than 90 degrees. With development within McKee Peak increased traffic volumes on Upper Sumas Mountain Road will support re-aligning this intersection to 90 degrees. Connection to the extension of Westview Boulevard would also improve the safety and performance of Ward Road.

## 6.4 Roadway Characteristics

In order to create an attractive and safe environment special attention is suggested to roadway characteristics. Creating attractive residential streets requires:

- automobile tolerant, as opposed to automobile dominant, narrow local streets
- variety and unique character
- curved streets with low design speeds
- pedestrian friendly streets
- retention of natural features and vegetation
- heavily landscaped boulevards and medians
- design which is subordinate to terrain
- smooth as opposed to hard surfaces and edges
- non-uniform, low lighting
- sporadic parking opportunities.

Streetscape design should strive to create attractive residential streets within the public road rights of way. By creating more intimate, pedestrian friendly streets developers can create liveable, attractive neighbourhoods rather than the traditional one-size fits all approach to subdivision design.

### 6.4.1 Engineering Road Design Influences

Road design standards which tend to have the greatest influence on subdivision design and the overall character and feel of a neighbourhood include:

- pavement width
- extent of on-street parking
- design speed, which affect horizontal and vertical curve/alignment
- overall road grade
- location and number of sidewalks
- driveway grades.

Desirable residential streets are unique rather than uniform in appearance and character. During subdivision design particular consideration should be directed towards establishing unique, non-uniform local roads, as opposed to one-size fits all standard.

One element that contributes to unique streets is lighting. Discreet, non-uniform lighting can enhance the character of residential communities. By lowering the overall light levels within residential local streets, the impact of the road on the overall streetscape and its visual impact on the natural land form from distances afar can be mitigated.

### 6.4.2 Engineering Design Standards

The steep terrain and environmental attributes in the plan area may warrant a significant departure from the typical residential streets within the City. In addition, attractive residential communities encompass attractive streetscapes. It is recommended the City consider modifying the engineering design standards for mountainous terrain to produce a much narrower, more environmentally friendly streetscape and appearance. The result will be slower traffic speeds through residential neighbourhoods, more flexibility to accommodate steep terrain and grade changes, fewer large cuts and fills with significant retaining structures and a pedestrian friendly environment where the roads become automobile tolerant, as opposed to automobile dominant.

The following design principles are suggested for the McKee Peak Plan Area. All of these principles will require amendment to the Subdivision and Development Bylaw.

- Pavement Width
  - Local Roads = 6 metres, plus 2 metre parking bays, where appropriate (sporadic)
  - Collector Roads = 8 metres, plus 2 metre parking bays (sporadic or continuous dependant upon adjacent land use)
- Design Speeds
  - Local Roads = 30 kph
  - Collector Roads = 40 kph
- Maximum Gradients
  - Local Roads = 15%
  - Collector Roads = 12% (with the flexibility to increase gradient, subject to maximum length of 200 metres)
  - Driveway Grades = not regulated
- Sidewalks
  - Local Roads = no sidewalks
  - Collector Roads = one side.

### 6.4.3 On-street Parking Standards

Many low density residential neighbourhoods within the City occupy less than 50% of the space allocated for on-street parking. This abundance of on-street parking space creates additional storm water run-off, encourages faster traffic speeds and reinforces the automobile dominant approach to subdivision design. It is recommended the City adopt narrower pavement widths, combined with sporadic parking bays constructed of pervious materials to enhance rainwater management principles. The extent and number of parking bays will depend upon adjoining land uses; however a typical residential cul de sac with 25 homes could be serviced with three (3) two vehicle parking bays.

Some collector routes may require parking aisles, as opposed to parking bays, where higher density or commercial projects warrant; otherwise parking bays should suffice on most collector routes.

## 6.5 Emergency Access

The current standard of single access routes into new residential neighbourhoods is becoming more of an issue as development occurs on mountainous terrain. Topographic constraints limit alternative access opportunities. The overall land use plan for the McKee Peak Plan Area can be developed by minimizing the size of isolated pockets of residential development where practical, and rather than establishing a standard for emergency access based on distance as is the current practice, this requirement should be based upon the development of major community facilities at which point the provision of secondary access becomes a



more critical feature. There are numerous examples across the Province where entire subdivisions have a single access point, as well as, substantial new residential projects (e.g. along the Sea to Sky corridor).

## 6.6 Multi-modal Transportation Opportunities

The trail system should be designed to accommodate a variety of recreational pursuits, such as mountain biking, hiking, walking, and nature viewing. Due to the steep terrain it is not anticipated many trails would be wheel-chair accessible; however viewpoints adjacent to local roads could be wheel-chair accessible.

It is expected that there will be local and collector roads with grades over 12%; as such they will be a challenge for most bike riders. The proposed narrow local and collector roads will enhance cycling safety as traffic speeds should be slower than typical residential streets. It is not recommended to create separate bike paths or lanes within the collector and local road network system.

Given slope conditions and the relative lack of employment opportunities within the northeast quadrant, it is not anticipated that pedestrian or bike modes of transportation will become dominant in the future.

## 6.7 Transit

Transit service to this sector of the City is currently provided by the Central Fraser Valley Transit System; regular service is available throughout the day on Route 1: the Blueridge - McKee Go Line.

In support of the City's public transit policies, consideration should be given to providing additional transit services as development occurs, and as a means of offering increased mode choice. Alternative transit services for low demand areas or low time periods may include community shuttle buses, taxi-feeder services and demand responsive paratransit such as dial-a-bus. These services may be accommodated on the internal circulation network utilizing Westview Boulevard and connecting to Sumas Mountain Road and McKee Road to form a convenient transit loop.

## 6.8 Traffic Impacts

A macro level traffic review was undertaken of the proposed development at McKee Peak. The objective was to assess at an overview level the traffic implications of the proposed residential development on the adjacent road network, and to identify any necessary mitigation measures required to support the proposals. Changes to background traffic volumes may lead to additional improvements outside of the plan area.

Traffic generated by the proposed land use was estimated using the Institute of Transportation Engineers vehicle trip generation rates (ITE Trip Generation Manual, 5<sup>th</sup> Edition). Site generated vehicle trips were distributed and assigned on the basis of the location of the developable area relative to the local street network, and the assumption that the majority of trips were destined to the west and the south.

Given the limited number of east-west arterial and collectors routes traversing the City limits, the increases in volume from this development may result in existing facilities such as Old Yale Road and South Fraser Way, operating under over-saturated conditions precipitating the need to add east-west capacity to the City's network. Additional capacity may be required at some of the interchanges on Highway 1.

Specific findings include:

- The daily trip generation for the McKee Peak plan area will be in the order of 35,600 trips per day (illustrated in Figure 7).
- Approximately 2,750 trips (total two-way traffic) per hour will be generated during the morning peak and 3,670 during the afternoon peak.

- The McKee Road Corridor will experience an increase of between 26,900 (weekday) and 28,100 (Saturday) vehicles per day, which likely can be accommodated in the proposed four lane roadway.
- The Lower Sumas Mountain Road Corridor relocation is assumed to be deferred until the development of the Clayburn Industries Lands, as well as the eastern extension of Westview Boulevard.

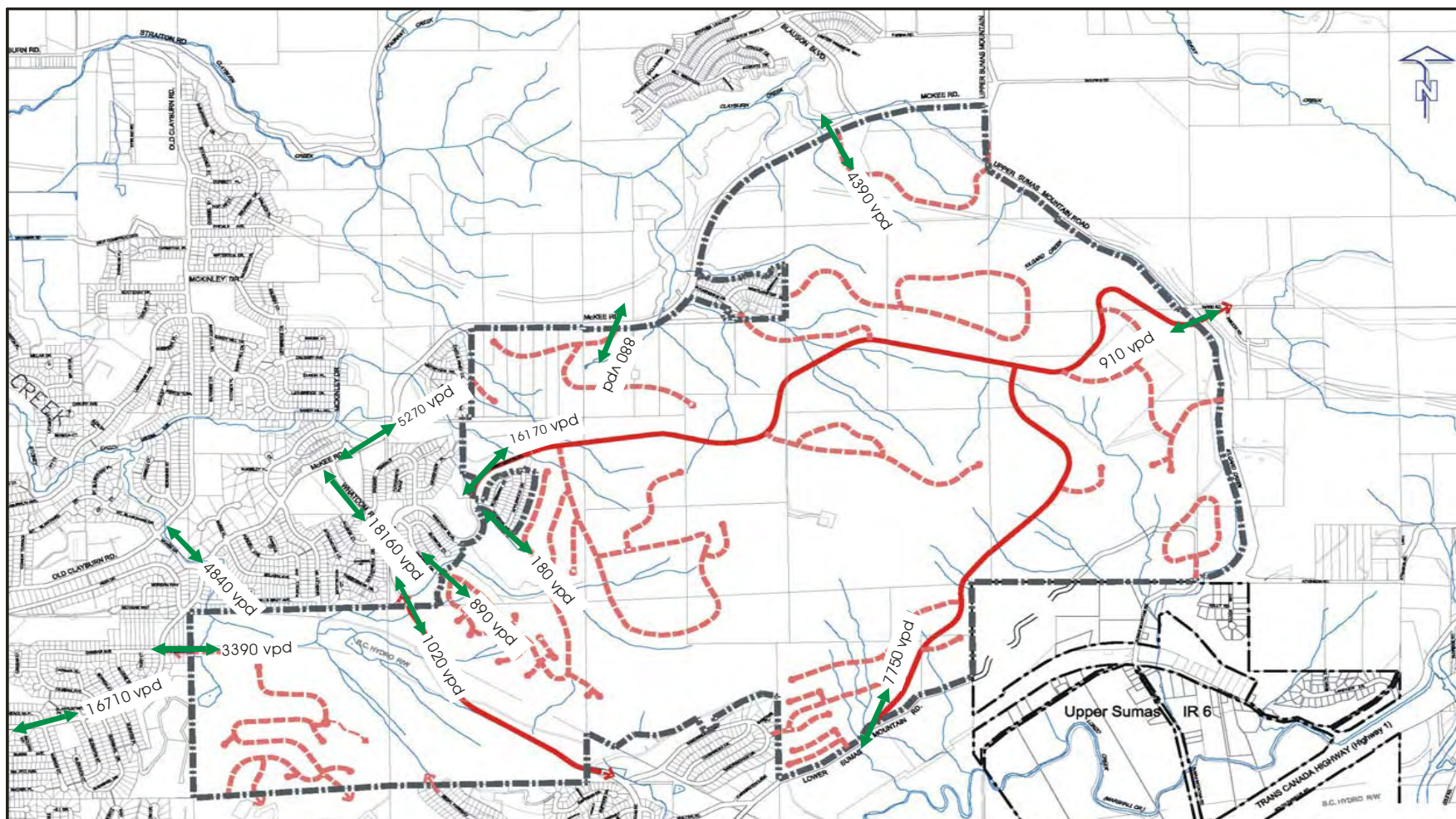
Westview Boulevard will become the prominent east-west connector within the study area. Traffic volumes generated from the options proposed will create a need for four (4) travel lanes from Whatcom Road to future intersection with Lower Sumas Mountain Road. As development occurs the location of the transition between 4 lanes and 2 lanes should be reviewed further.

- As Clayburn Industries site develops the extension of Westview Boulevard should be a priority.
- Increases in background traffic as well as site generated trips will likely warrant the signalization of the intersection of McKee and Whatcom Roads, as well as the downstream intersection at McKee and McMillan Roads, and possibly McKee Drive at each end.

McKee Road should have provision for four (4) travel lanes from Whatcom Road to Sumas Way, via the Hazel Connector. Timing for this upgrade will be contingent upon site generated and background traffic volumes.

Road continuity within McKee Peak particularly the extension of Westview Boulevard and its function as an east-west collector road has also been considered. It is recognized that this road may not be continued for its full length unless it can be included as part of the Clayburn Industries redevelopment plan (once mining ceases). The need for a secondary access for development using Westview Blvd, via Buckingham Drive is an important, but not critical element in the short term. In the interim smaller scale residential development to the south is feasible. However, as local amenities such as the school, regional City park and the village commercial area develop, there will be an increased need for a secondary access for circulation and emergency vehicles (which can be accomplished by a connection to Buckingham Drive).

Figure 7 - Site Generated Traffic – Daily Two Way Trips





# 7.0 Utilities

## 7.1 Rainwater Management

### 7.1.1 Introduction

The majority of land at McKee Peak contains mixed forest, primarily deciduous trees, with a few scattered acreage type homes on large parcels. The median slope is approximately 27% within the entire study area.

The area drains into two primary watercourses, Clayburn Creek and Marshall Creek. Within these watersheds there are four (4) sub-catchment areas, referenced in this report as Stoney Creek, Clayburn Creek, Marshall Creek and Kilgard Creek as shown on Figure 8 - Catchment Areas. Clayburn Creek discharges to Matsqui Slough in the Matsqui Prairie, while Marshall Creek discharges to the Sumas Drainage Canal within Sumas Prairie. Stoney Creek discharges to Clayburn Creek and Kilgard Creek discharges into Marshall Creek.

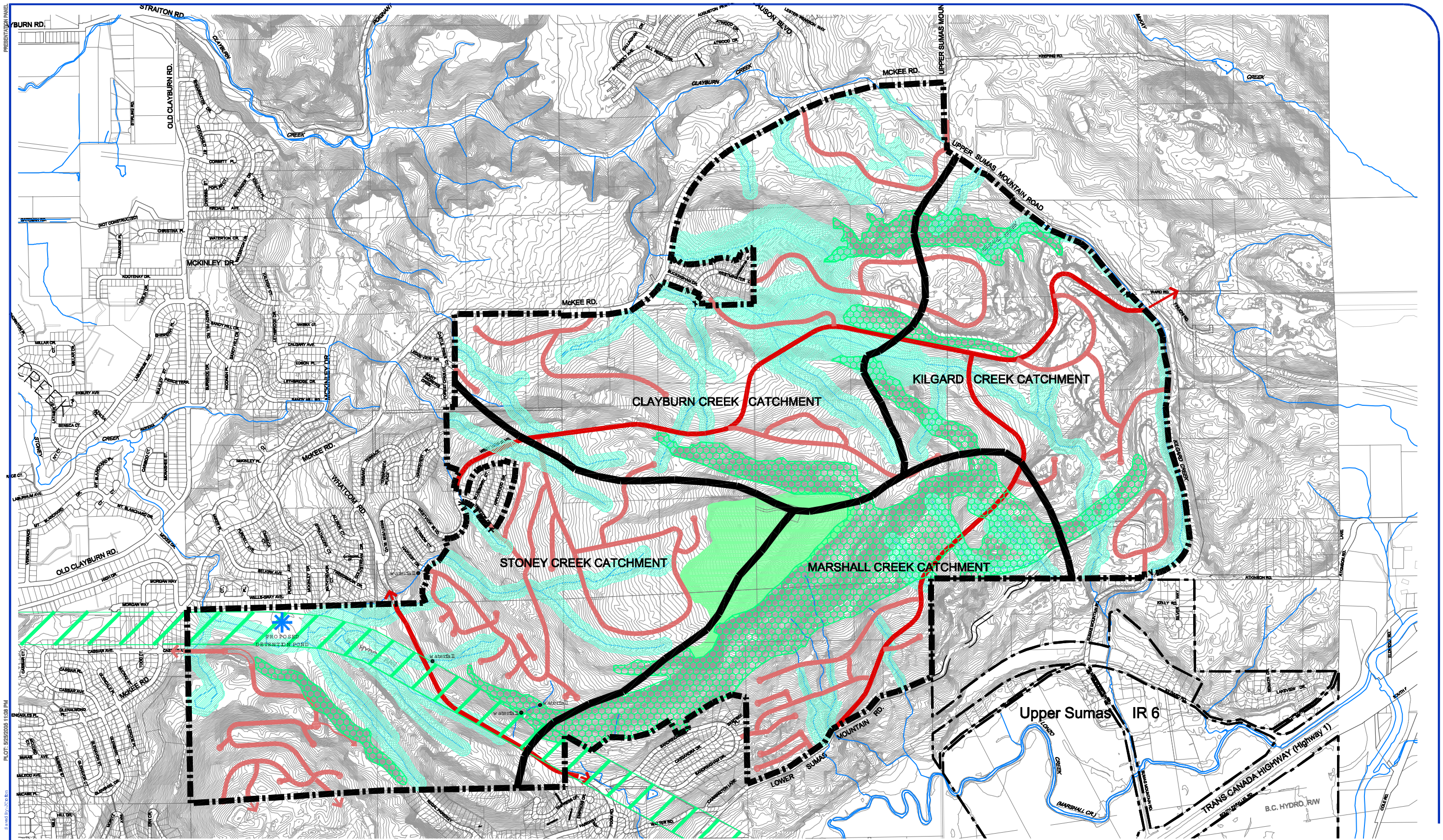
The City of Abbotsford, and the District of Matsqui prior to amalgamation, has investigated the impacts associated with urban storm water runoff on downstream receiving lowlands since the 1980's. The District of Matsqui established storm water runoff standards in the early 1990's, which lead the way toward mitigating the impacts of urban development on watercourses and lowlands within the Matsqui and Sumas Prairies.

Approximately 60% of the study area drains into Clayburn Creek, while the balance discharges to Marshall Creek. Clayburn Creek passes through Clayburn Village, a small historic residential community, and Stoney Creek dissects existing residential neighbourhoods west of the study area. Marshall Creek discharges into Sumas Canal east of I.R. #6.

The Kilgard Creek sub-catchment area is contained mostly within lands occupied by Clayburn Industries, while the Marshall Creek sub-catchment area contains significant conservation bluff areas and Columbia National Investments - Falconridge development. Kilgard Creek passes through Sumas Indian Reserve #6.

The City of Abbotsford has spent considerable resources and effort toward managing urban stormwater runoff within both watersheds.





- MAJOR PLANNED ROAD
- PROPOSED LOCAL ROAD
- BLUFF CONSERVATION AREA
- RIPARIAN BUFFER
- PARK

Figure 8: CATCHMENT AREAS





### 7.1.2 Stormwater Management

Stormwater Management has been practiced throughout Lower Mainland municipalities for the last two decades. The term Stormwater Management was applied to the efficient collection of stormwater runoff by detaining peak short and long duration storm events in man-made structures. As land development activities changed the receiving environment by removing the forest cover and absorbent soils, stormwater runoff resulted in larger volumes and deterioration of water quality. As forested areas are replaced with impervious roads, sidewalks, driveways and buildings, less water is infiltrated into the ground thereby creating more surface runoff and less ground absorption. This increased surface runoff, in turn, was efficiently captured in piped stormwater drainage systems, detained and discharged to existing watercourses. Under the traditional stormwater management model there has been a disconnect between the watershed or catchment area planning completed at the neighbourhood level, with the infrastructure constructed during the subdivision design and the extent of source controls provided during building construction.

This traditional approach to stormwater management is currently being replaced with a more holistic approach, one that considers impacts to streams, other environmental attributes, groundwater and downstream flooding. This new approach has been coined rainwater management.

In May 2002 the then BC Ministry of Lands, Water and Air Protection published a document titled “Stormwater Planning: A Guidebook for British Columbia”. The approach presented within this guideline has been embraced as principles worth pursuing within the McKee Peak area.

### 7.1.3 Previous Drainage Studies

Previous drainage studies have been completed or are nearing completion for both the Clayburn Creek and Marshall Creek watersheds. These include:

- Clayburn Creek Drainage Study for the District of Matsqui – Dayton & Knight, 1991
- Stoney Creek Drainage Study for the City of Abbotsford – Dayton & Knight, 2002
- Clayburn Creek Drainage Study for the City of Abbotsford – Associated Engineering, 2004
- Marshall Creek Integrated Stormwater Management Plan for the City of Abbotsford – Kerr Wood Leidal Associates Ltd., 2005
- Feasibility Evaluation of Stormwater Source Control Strategies for the Vicarro Ranch Development Area – CH2M Hill, 2005

The recommendations contained within each of the referenced drainage studies remain valid when reviewing development applications within the McKee Peak Planning Area. The principal recommendation in the Dayton & Knight, 1991 Clayburn Creek Study was the establishment of a detention facility within the BC Hydro corridor within the study area (Vicarro Ranch development). The planned storage capacity in two detention ponds is 50,600 cubic metres.

The Dayton & Knight study found the outlet from the Willband Sump, adjacent to Clayburn Creek, to the Fraser River can only convey a 2 year storm flow in accord with the Agri-food Regional Development Subsidiary Agreement (ARDSA) criteria without flooding adjacent land.

The 1991 report also outlined a number of options to manage stormwater runoff within the Clayburn Creek watershed. One option was stated as *“developers can be required to lengthen the concentration times by providing larger detention basins and/or by not directly connecting some properties and/or impervious*

*areas to the public storm sewer system*". The report concluded this option was unrealistic or ineffective. This planning review challenges that conclusion.

The results of the Kerr Wood Leidal study for Marshall Creek were not available at the time of preparing this planning report.

The focus of this planning study is to consider a change to current traditional practices and standards.

#### **7.1.4 Current Development Standards**

Development standards pertaining to stormwater management and drainage are contained within the City's Subdivision and Development Bylaw # 1125, 2002. A summary of design criteria includes:

- Minor drainage system shall be designed to safely convey the 10-year event
- Major drainage system shall be designed to safely convey the 100-year event
- A stormwater management plan is required for developments greater than 0.5 ha and shall include techniques such as detention, lot grading, subsurface disposal, storage, erosion control and other methods to mitigate runoff impacts due to land use change
- Infiltration facilities can be used for rooftop runoff from multi-family, commercial and industrial developments, where soil conditions are conducive to percolation, to reduce the need for downstream detention storage
- Runoff from developments and subdivisions shall be controlled to prevent or mitigate flooding and environmental impacts
- The allowable release rate in the City is 5 l/s/ha of development. Storage is sized to detain runoff of flows in excess of the allowable rate
- Facilities are designed for flows in excess of the 100-year where the downstream drainage system cannot accommodate the 10-year flow
- Culverts located on natural watercourses shall convey the 100-year major flow
- Permanent open ditches are not acceptable within the City.

Some of these design criteria should be reviewed in light of the rainwater management approach. Specific recommendations pertaining to Subdivision and Development Bylaw amendments are noted at the end of this section.

#### **7.1.5 Rainwater Management Guidelines**

The McKee Peak Planning Area is an ideal candidate for the consideration of rainwater management guidelines. It is located upstream of low-lying agricultural lands, the receiving watercourses are important fish bearing creeks and the steep topography requires innovative approaches to control the volume and velocity of stormwater runoff. Depending upon the site and soil characteristics down stream detention facilities may still be required.

#### **Source Control**

A key component in rainwater management is source control. The Greater Vancouver Regional District (GVRD) has developed and promoted a series of publications espousing the benefits of source control. Examples of source control measures include:



- Absorbent landscapes
- Rain gardens
- Vegetated swales
- Pervious paving
- Infiltration trenches
- Green roofs.

With the possible exception of green roofs, all of these source control methods can be considered within the McKee Peak Planning Area. The effectiveness of each type of source control requires further review taking into consideration site specific soil characteristics, topography and site development. Improvements to existing soil structure can enhance performance of source control measures. Additional efforts will be necessary to slow the velocity of surface flows to allow time for infiltration to occur.

Prior to implementing a source control program, detailed geotechnical investigations are necessary so as to not jeopardize geotechnical stability of slopes.

By directing impervious surfaces to absorbent landscape areas, rather than piped drainage systems, the management of stormwater runoff can become easier to implement. The current approach of constructing onsite and community detention facilities requires a high degree of coordination and effort by City staff and developers to address issues from land acquisition to environmental agency approvals. Onsite source controls also require a high degree of coordination; however this coordination can be managed by the developer without external or third party approvals. The rainwater management approach focuses on capturing rainwater at its source, returning it to ground and conveying excess and extreme flows overland to natural watercourses.

### **Impervious Surfaces**

Reduction of impervious surfaces, both within the public and private domains, is a key element with the adoption of rainwater management principles. Within the public road right of way significant reductions (up to 50%) in impervious surfaces can reduce stormwater runoff volumes and direct flows to infiltration facilities within the right of way. Narrower pavement width, introduction of pervious parking bays, reduction in the amount of concrete sidewalk and use of pervious paving and alternate sidewalk materials produces a significant reduction of stormwater runoff from public spaces. Public park sites can also be used to infiltrate stormwater runoff and temporarily store excess water from public facilities.

Private residential construction can reduce stormwater runoff by discharging roof-water and other impervious surfaces to ground. Builders should be encouraged to use pervious paving stones, limit the size of driveways, direct driveway runoff to pervious surfaces, place absorbent landscape soils and plant materials and utilize rain garden techniques on each parcel. Finally, limits can be placed on the extent of permitted impervious surface within building lots/parcels.

### **Minor Flooding**

Minor flooding during large and extreme storms can be considered outside of the building envelop, in areas such as parking, landscaping, boulevards, parks, schools and open space and portions of the local road network. Traditionally, flooding has been seen as an unacceptable alternative when considering stormwater design; however with public education and proper notification, residents' attitudes towards minor localized flooding can change.

## Infiltration

Rainwater infiltration is dependant upon the permeability of the natural soil, grade, sediment control and compaction. It is difficult to improve the permeability of the natural soil, or change the overall grade of the land; however transport of sediments which clog soils and infiltration systems are important to control. Sediments should be controlled at both the subdivision stage and at the lot level during house construction. Constructed infiltration systems need to be designed to prevent introduction of sediment. In addition, the life-span of each type of infiltration system (typically 10 – 15 years) needs careful consideration at the planning stage. Future maintenance obligations, both public and private, need to be clearly defined, so that expectations can be attained with this new approach.

### 7.1.6 Goals and Performance Standards

The goals for managing rainwater within the McKee Peak Plan Area could include:

- Allow development to occur which does not compromise the health, sustainability and stability of existing natural environment, including water courses and ravines.
- Consider rainwater management as a tool to manage the effects of development on the natural environment.
- Rainwater management techniques can be utilized to mitigate downstream flooding and erosion, release rainwater back to the environment in a natural way and maintain pre-development flow conditions.

The following performance standards can provide a framework for implementing rainwater guidelines, which are designed to reduce the volume and rate of runoff, and improve water quality. It is suggested specific performance targets be adopted for the McKee Peak Planning Area with adoption of the Integrated Stormwater Management Plan (ISMP) for each watershed – Clayburn Creek and Marshall Creek. The Marshall Creek ISMP is currently under review by Kerr Wood Leidal.

- Do not allow direct discharge of storm drainage to a watercourse  
By day-lighting the pipe system at least 150 metres before it enters a natural watercourse, water velocities can be reduced and water quality improved, prior to discharge to the environment. An example of this technique has been used in Heritage Woods, Port Moody.
- Retain natural forest areas to accept stormwater runoff  
Directing stormwater runoff to natural forest areas can dissipate flows and allow for infiltration and evaporation to occur.
- Convey long duration, extreme 100 year storm events  
Each subdivision should consider 100 year flow routes as development proceeds up the slope. Particular attention should ensure lower subdivision designs do not cut-off up-slope 100 year flow routes. Minor flooding can be permitted outside of the residential building envelop to reduce surface flows during extreme events.

Energy dissipation and controlling the velocity of storm flows will be critical. Measures, such as the waterfall used at Eagle Mountain, need to be developed at the subdivision design stage in order to effectively accommodate the 100 year flows and energy dissipation.

- Maintain healthy streams

The Benthic Index of Biological Integrity (B-IBI) is a measure of the health of streams. For environmentally sensitive streams a B-IBI baseline and monitoring program should be considered in order to gauge the impact of removing forested areas and replacing it with impervious urban development. A study conducted by Horner and May 1996 – University of Washington concluded there is a direct correlation between the amount of impervious area and stream health. Kerr Wood Leidal Marshall Creek ISMP 2004 report on existing conditions supports implementing low impact development standards to reduce the total impervious area (TIA) within that watershed, resulting in healthier streams (higher B-IBI score).

The City should consider reviewing the allowable release rate for storm water design in order to reduce the volume of urban runoff.

- Use the road right of way area as a public open space amenity

By considering the boulevard area as public open space amenity, residents can assume pride and “ownership” of this area, which inspires neighbourhood participation with maintenance duties and leads to a safer environment. The scope and scale of street plantings can be expanded to include shrubs, perennials and conifers. Conifers are particularly beneficial at capturing and holding winter rainfalls.

### 7.1.7 Recommendations

#### Integrated Storm Water Management Plans

An integrated stormwater management plan (ISMP) should to be developed for the Clayburn Creek Watershed, focusing on the planned urban expansion areas within McKee Peak and Auguston Plan Areas. Working with environmental agencies the ISMP can consider low impact development standards to manage rainfall at the source, including reduction of public and private impervious areas. The ISMP can also create a technical manual for implementing onsite source control measures. The Kerr Wood Leidal report on the Marshall Creek watershed, is based on similar principles and its recommendations regarding low-impact development could be considered in the McKee Peak Area.

#### Pilot Project

As low-impact development standards are relatively new within the Georgia Basin, the City may wish to consider creating a pilot project within the study area to fully engage the principles of rainfall management. A monitoring program should be established to determine the project’s effectiveness in terms of flow reductions (volume and velocity), water quality improvements operational costs and applicability to steep terrain site conditions. Local universities or colleges could benefit from research opportunities gained through monitoring a pilot project designed to improve stormwater management.

#### Review Subdivision and Development Bylaw Standards

Consider appropriate runoff release rates for each major watershed within the City, eliminate the restriction (currently allowed only on multiple family, commercial and industrial projects) on infiltration to ground to include all land uses, reduce the runoff from road, parking and sidewalks, allow permanent open swales and eliminate storm service connections, where appropriate. Consider standards for controlling transport of sediment both at the subdivision and the lot level.

The current allowable release rate for storm water design is 5 l/s/ha of development, which was established by the City prior to the principles of rainwater management being developed. Also, the Clayburn Creek

discharge to the Fraser River, via Matsqui Slough, is constrained to the 2 year design flow without flooding adjacent farmland. As a result, this current City-wide standard should be reviewed.

The MMCD Green Infrastructure Committee will be releasing a paper to guide local government with modifications to subdivision bylaws incorporating “green” principles. In conjunction with reviewing the specific bylaw standards recommended above, the Subdivision and Development Bylaw can be amended to include rainwater management principles generated by this Committee.

### Implementation Strategies

Traditionally the Building Division’s role in monitoring construction of onsite stormwater source controls has been limited. Implementing onsite source controls will require plan reviews, security deposits to ensure performance and monitoring over the long-term to satisfy operation and maintenance obligations.

The developer can assist by preparing design requirements and maintenance manuals for their builders, and then conduct inspections during the construction to ensure compliance.

The Community and Environmental Planning Division can take the lead role in establishing and maintaining an ongoing communication program designed to inform the public of the merits of rainwater management principles and resident’s responsibilities.

## 7.2 Water Distribution

### 7.2.1 Introduction

Recently, the City of Abbotsford and the District of Mission have jointly assumed operation of the Fraser Valley Regional District’s (FVRD) water supply system. The former FVRD system supplies both Abbotsford and Mission, and is primarily supplied from the Norrish Creek Water Treatment Plant (WTP), with additional water supplied from Cannell Lake north of Mission and wells in Abbotsford as illustrated in Figure 9.

The WTP uses both slow sand and membrane filtration to treat the water. The plant’s current capacity is 117ML/d (90ML/d slow sand and 27ML/d membrane). The membrane portion of the plant can be expanded in 27ML/d modules to 108ML/d, for a total treatment capacity of 198ML/d. The current water license is for 145ML/d, and to realize the total potential of the membrane plant, a larger control structure must be constructed at the headwaters of Norrish Creek (Dickson Lake).

A review is being undertaken regarding options for additional source of water including:

- Additional groundwater wells in Abbotsford
- Stave Lake
- Harrison Lake
- Fraser River
- Chilliwack Lake

The former FVRD system had target Hydraulic Grade Lines (HGL’s) to maintain water supply at the following locations:

- Mary Anne Reservoir (Mission) – 206m
- Best Ave PRV (Mission) – 149m



- Best Ave PRV (Mission) – 149m
- Ackerman Reservoir (Abbotsford) – 181m
- Maclure Reservoir (Abbotsford) – 123m

The McKee Peak plan area is generally supplied by a 1050mm diameter trunk main installed with the second Fraser River crossing from Hatzic south to Page Road, south west to Beharrell Road, then south Clayburn Road. From here it follows Old Clayburn Road to McKee Drive. A 600mm water main then branches off at this point to the Selkirk Booster Station (McKee Road and Selkirk Avenue). This booster station is at an elevation of 93 metres.

The Selkirk Booster Station pumps water up to the McKee Reservoir (off McKee Road) at elevation 237m and supplies pressure Zones 181, 237. Water is pumped again to supply Zone 296.

**Context**

The analysis utilized MWHSOft’s H2OMAP software and the City’s water model, which Dayton & Knight Ltd. has recently calibrated.

**7.2.2 Previous Water Studies**

Previous water supply studies have been completed for various portions of the McKee Peak study area. These include:

- McKee Water System Review – Dayton & Knight, 2003
- Central Fraser Valley Water Commission 2002 Update of Water Master Plan - Dayton & Knight, 2003
- Auguston Development Master Water Distribution Plan – InterCAD, 1998

The 2003 McKee Water System Review recommended the creation of four separate pressure zones above the existing Zone 237. These zones are described in Table 7-1 below.

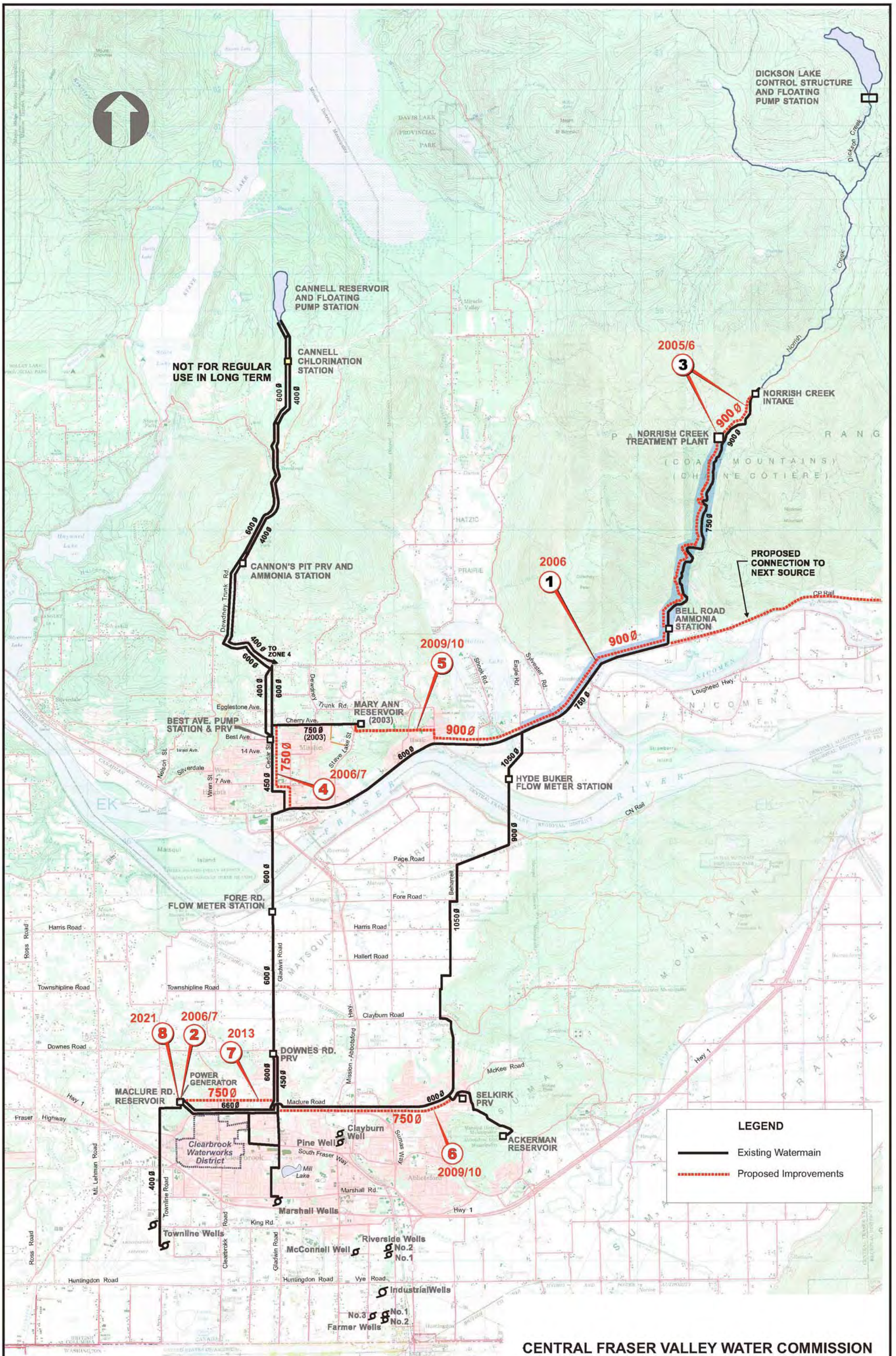
**Table 7-1 - Proposed Pressure Zones**

Zone HGL (m)	Source	Service Contour			
		Minimum		Maximum	
296	PRV from 356	207 m	(120 psi)	266 m	(43 psi)
356	McKee Booster	266 m	(120 psi)	326 m	(43 psi)
411	PRV from 467	326 m	(120 psi)	381 m	(43 psi)
467	Boosted from 356	381 m	(135 psi)	437 m	(43 psi)

These pressure zones are suitable for the McKee Peak plan area. Additional pressure zones on the south side of McKee Peak will be required to conform to the existing pressure zones. The proposed system hydraulic schematic is illustrated in Figure 10.

These zones are based on available contour information, and may change once more detailed survey information is available. It should be noted that the City’s new design criteria is that a minimum pressure of 300 kPa (44 psi) is required at 5m above the minimum basement elevation (MBE). This will affect houses constructed near a pressure zone boundary, and may require some houses to move from one pressure zone to a higher one to meet the new criteria. Determination of which individual dwellings are to be included in each pressure zone will form a part of the detailed design by the developer.





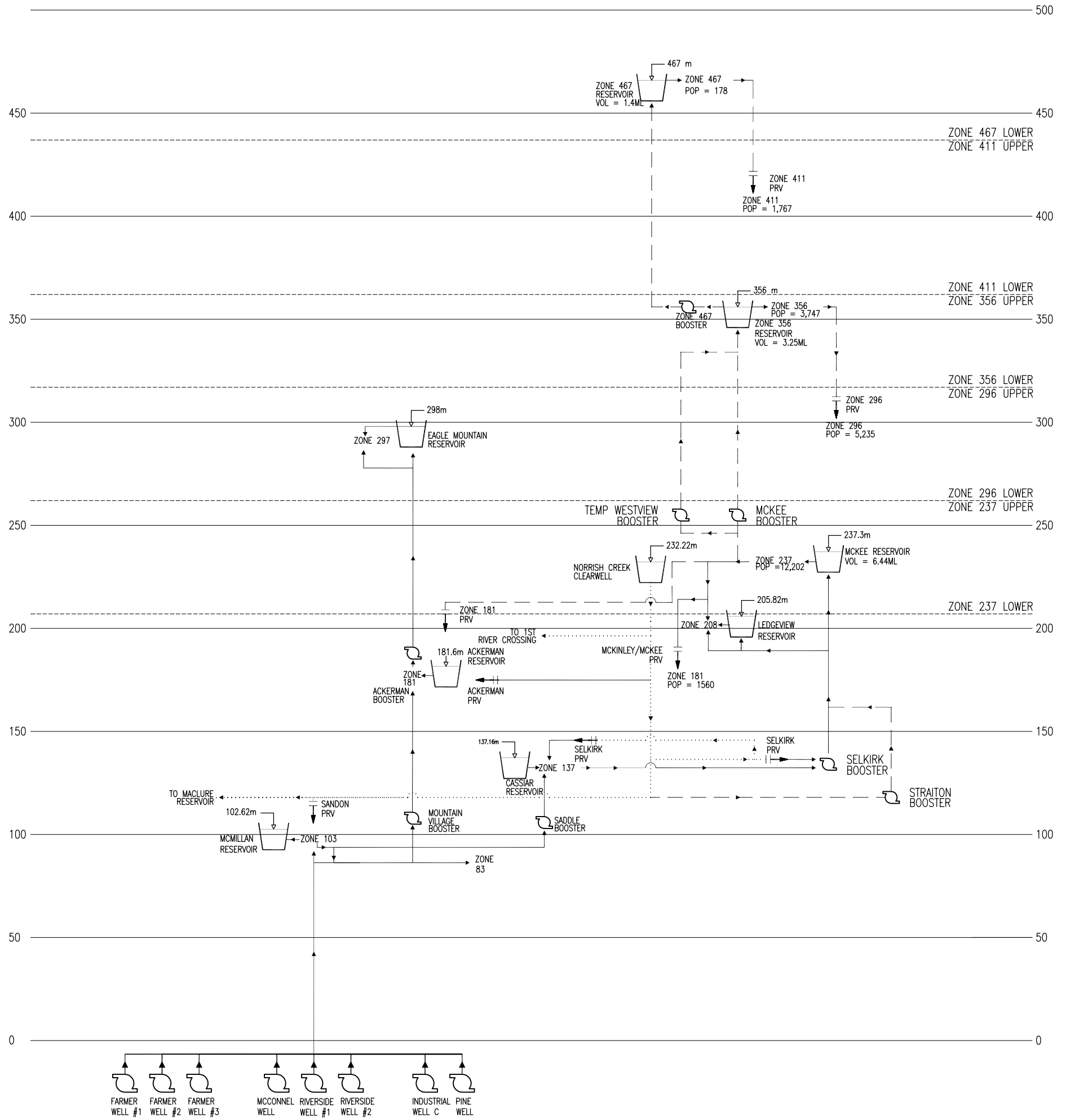
**CENTRAL FRASER VALLEY WATER COMMISSION  
2002 UPDATE OF WATER MASTER PLAN  
PROPOSED SYSTEM IMPROVEMENTS**

Figure 9



ELEV. (m)  
GEODETTIC

ELEV. (m)  
GEODETTIC



**Watermain Legend**

- Existing Mains
- ..... FVRD Mains
- - - Proposed Mains

**FIGURE 10**  
**MCKEE PEAK STUDY**  
**WATER DISTRIBUTION SYSTEM SCHEMATIC**



### 7.2.3 Current Development Standards

The current development standards for water distribution are contained within the City's Subdivision and Development Bylaw No. 1125-2002. The design criteria include demand, minimum pressure, and fire flow requirements.

#### Demand Requirements

Demand requirements are:

**Table 7-2 - Demand Requirements**

Condition	Demand (lpcpd)
Average Daily Flow	570
Maximum Daily Flow	1,364
Peak Hour Flow	2,200

#### Pressure Requirements

Service pressures are:

**Table 7-3 - Service Pressure Criteria**

Condition	Pressure	
	kPa	psi
Minimum Peak Demand Pressure at 5m Above Minimum Basement Elevation	300	44
Maximum Allowable Pressure	830	120
Minimum Fire Hydrant Pressure (Residual)	150	22

#### Fire Protection and Storage

Water distribution systems must be able to deliver large volumes of water for fire protection in addition to normal water demands. Fire protection considerations are:

- Only one fire will be fought at any one time.
- To ensure pumper trucks obtain adequate water supplies from hydrants, a minimum residual pressure of 150 kPa (22 psi) on the street main is required during fires.
- Fire flow is coincident with peak day demand.

Fire flow criteria are based on Abbotsford Bylaw No. 1125-2002 and are shown in the following table. Required durations of fire flow were based on Fire Underwriters Survey "Water Supply for Public Fire Protection – A Guide for Recommended Practice" (Latest Edition), and are also listed in Table 7-4.

**Table 7-4 - Fire Flow Criteria**

Zone	Required Minimum Fire Flow		Required Duration of Fire Flow
	(L/s)	(L/min)	(Hours)
Low Density Residential ( $\leq 16$ units/ha)	75	4,500	1.75
Medium Density Residential ( $>16$ units/ha & $\leq 45$ units/ha)	120	7,200	2.0

Zone	Required Minimum Fire Flow	Required Duration of Fire Flow
High Density Residential (> 45 units/ha)		
Wood Frame	167      10,020	2.0
Non Combustible	117      7,020	2.0
Industrial		
Wood Frame	167      10,020	2.0
Non Combustible	117      7,020	2.0
Institutional		
Wood Frame	167      10,020	2.0
Non Combustible	117      7,020	2.0
Commercial		
Wood Frame	167      10,020	2.0
Non Combustible	117      7,020	2.0

**7.2.4 Service Populations**

The total service population affecting the study has been separated into the population inside the McKee Peak Plan Area, the population of the Auguston Development and the ultimate population at OCP build-out outside of the plan area. It is important to differentiate the existing population and future OCP build-out populations outside of the McKee Peak Area separate from the McKee Peak Area to provide the context for the potential allocation of available service capacity over time.

**Outside McKee Peak Planning Area**

The existing populations for pressure zones 181, 237, and 296 are shown in Table 7-5. These have been calculated using the following population assumptions:

- 3.3 persons per single-family (SF) unit
- 2.4 persons per multi-family (MF) unit
- 3.0 persons per multi-family (MF) unit in Zone 296. This population density was determined by the City and the Developer during the development approval stage.

The Auguston development at the northern portion of Zone 237 has been separated from the balance of Zone 237, and it is outside of the scope of this planning study.

**Table 7-5 - Existing Populations**

Pressure Zone	Existing SF Lots	Existing MF Units	Existing Population
181	352		1162
237 (Excluding Auguston)	214		707
296	76	67	452
Auguston Development	200		660
Total	842	67	2,981

Future Populations for the areas outside of the McKee Peak Study area are outlined in Table 7-6.

**Table 7-6 - Future Populations**

Pressure Zone	Future SF Lots	Future MF Units	Future Population
181	473		1,560
237 (Excluding Auguston)	384	145	1,616
296*	76	67	452
Auguston Development	807	1,600	6,934
Total	2,967	603	11,109

\*The remainder of Zone 296 forms a portion of this study, and is not included in this section.

**Within the McKee Peak Plan Area**

There are approximately 360 developable hectares outside the plan area that are to be serviced by the Selkirk Booster. Within the plan area, it is assumed that there will be an average of 11 units per hectare, with 3.3 persons per unit. This population density is based on the City’s bylaw value. The 11 units per hectare was a simplified assumption made based on a weighted average of the areas of single and multifamily developable areas.

Populations and areas within each of the pressure zones in the McKee Peak Plan Area are shown in Table 7-7 below.

**Table 7-7 - McKee Peak Plan Area Populations by Pressure Zone**

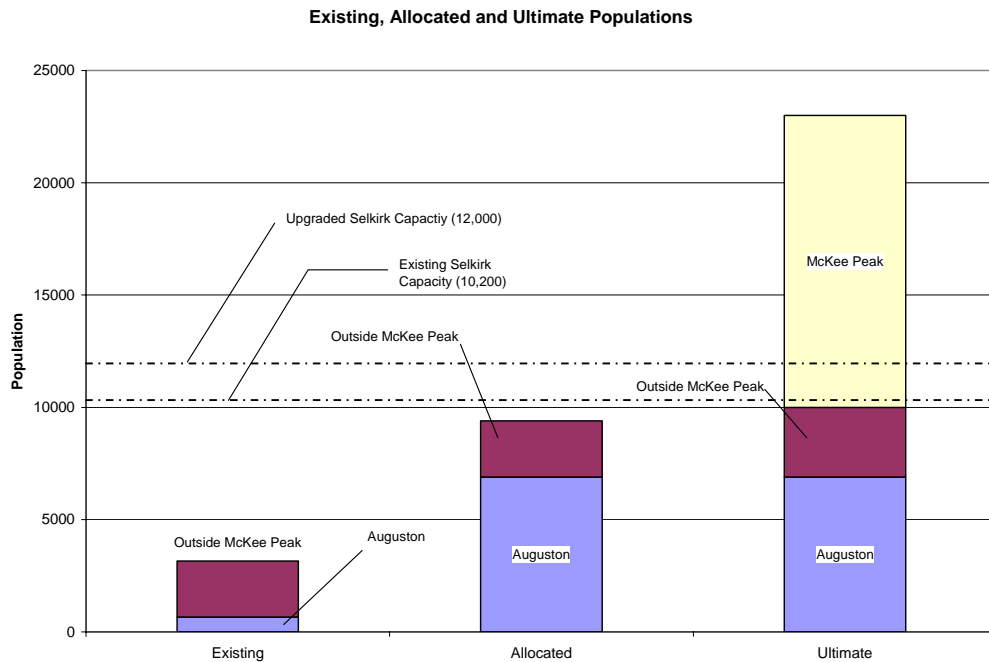
Pressure Zone	Area (ha)	Population
137	17.8	647
181	21.1	769
237	80.4	2,921
296	115.3	4,188
356	82.5	2,997
411	38.9	1,413
467	3.9	142
Total	359.9	13,077

Once the capacity of the Selkirk booster is reached (12,000 pop) a new water booster station will be required, that is the Straiton Booster Station.

The allocation of water and the capacity of the Selkirk Booster Station is represented graphically in Figure 11 following:



**Figure 11 - Population Allocation**



**7.2.5 Existing Facilities**

The plan area currently obtains water from the Selkirk Booster Station. The existing supply is via a 600 mm connection to the 900 mm main along Old Clayburn Road. This connection is at the intersection of McKee Dr and Old Clayburn Road, and supplies the Selkirk Booster.

It is understood that during peak summer demand periods, the Ackerman Reservoir does not reach its HGL target. Until this shortfall is addressed, the property in the plan area south of the BC Hydro right of way cannot be serviced (portion of Vicarro Ranch).

**Selkirk Pump Station**

The Selkirk Booster Station pumps water from the supply line to the McKee reservoir (Zone 237). The Selkirk Booster Station is currently equipped with four six-stage 125HP vertical turbine pumps. Assuming that three pumps are running with the fourth to provide backup, if changes to the controls on the suction side of the pump station are carried out, the pump station can provide flows for up to 12,000 persons. The existing configuration would service a population of approximately 10,200 persons.

The changes to the controls include abandoning the connection to Zone 137 and raising the suction HGL to 152m. This will require raising the PRV setting by approximately 17m.

It is assumed, with these changes in place, the Selkirk Booster Station can supply the ultimate development outside of the plan area (up to 12,000 persons) and any additional flows will require a new booster station.

### **McKee Reservoir**

The McKee Reservoir is a 3.44ML buried concrete reservoir, with a top water level of 237.3m. This reservoir is designed for peak flow balancing and fire flow requirements, and provision for a future cell to the south of the existing reservoir.

The capacity of the McKee reservoir is approximately 8,000 persons. This capacity is based on a fire flow requirement of 167L/s for duration of 2 hours (institutional & commercial uses) and a balancing requirement of 20% of peak day demands.

### **McKee Booster Station**

The McKee Booster Station currently boosts water from Zone 237 to Zone 296 to service 27 single family and 67 townhouse lots (currently under construction). It is designed to ultimately boost water to the Zone 356 reservoir for an equivalent population of approximately 9,000 persons.

### **Westview Booster Station**

The Westview Booster was constructed in 2004 to service the existing developments on Blueberry Court and Applewood Drive in Zone 296. The pump station consists of a 150 hp fire pump, two 20 hp duty pumps and a pressure reducing valve. By removing the pressure reducing function the existing fire pump can be converted to a duty pump to service the proposed Zone 356 reservoir.

To allow for redundancy within the pump station, the two existing 20 hp pumps will need to be replaced with two 60 hp pumps, each capable of discharging 28 L/s at 122m head. These pumps are the largest that can be installed in the existing pump station, and will limit the total population that can be serviced from this pump station.

The City has indicated no additional development within Zone 296 can occur without the construction of the Zone 356 reservoir due to risks associated with small booster stations. Once the reservoir is constructed and the Westview Booster modified, it will have a capacity to supply a population of approximately 3,600.

### **Ackerman Booster / Reservoir**

The Ackerman reservoir consists of a cast in place concrete reservoir with a volume of 3.93 ML and a booster station with a capacity of 86L/s at 134m head. The Ackerman booster pumps up to the Eagle Mountain reservoir to service the Eagle Mountain development, adjacent to the plan area.

### **Eagle Mountain Reservoir**

The Eagle Mountain Reservoir is a 3.72 ML concrete reservoir designed to service the Eagle Mountain development.

## **7.2.6 Long-Range Improvements**

There will be improvements required to provide water to the estimated 13,000+ population estimated for McKee Peak, as shown in Figure 12. These improvements include:

- New Straiton Booster Station
- New 600mm Straiton Trunk Water main
- New McKee Reservoir cell (3.0 ML)

- New 400mm McKee/Sumas Mtn Road water main
- New Zone 356 Reservoir (2.5 ML)
- Upgrade existing McKee Booster with 3-200 HP pumps to pump to Zone 356 Reservoir
- New 400mm Zone 356 water main
- New Zone 467 Reservoir (1.25 ML)
- New booster from Zone 356 to Zone 467

### **Straiton Booster Station**

The proposed Straiton Booster Station is planned on Straiton Road, approximately 1300m east of the intersection of Straiton and Old Clayburn Roads. It will consist of four 100HP pumps, capable of discharging 50L/s at 100m TDH. The TDH required is based on assumed 150m HGL from the City's 1050 mm supply main. This HGL was determined through the City's hydraulic model. An HGL of 150m corresponds to a flow from Norrish Creek of 150 ML/d, assuming the 900mm supply main from the Norrish Creek Water Treatment Plant is constructed, as per the Fraser Valley Water Commission's 2002 Update to the Water Master Plan.

Depending on the planned development outside of the current urban development area, it may be desirable to build the pump station to expand in the future. A detailed design should take additional populations into consideration.

### **Straiton Trunk Water Main**

The Straiton Trunk Water Main is proposed to be a 600mm water main beginning near the intersection of Old Clayburn and Straiton Roads, and runs 1300m east to the proposed Straiton Booster Station. From the booster, there are two possible alignments:

- Option A – 600mm water main beginning at the Straiton booster and running 3,725m along an existing sewer ROW to McKee Road
- Option B – 600mm water main beginning at the Straiton Booster and running 4,850m along Straiton/Dawson Roads to the McKee Road.

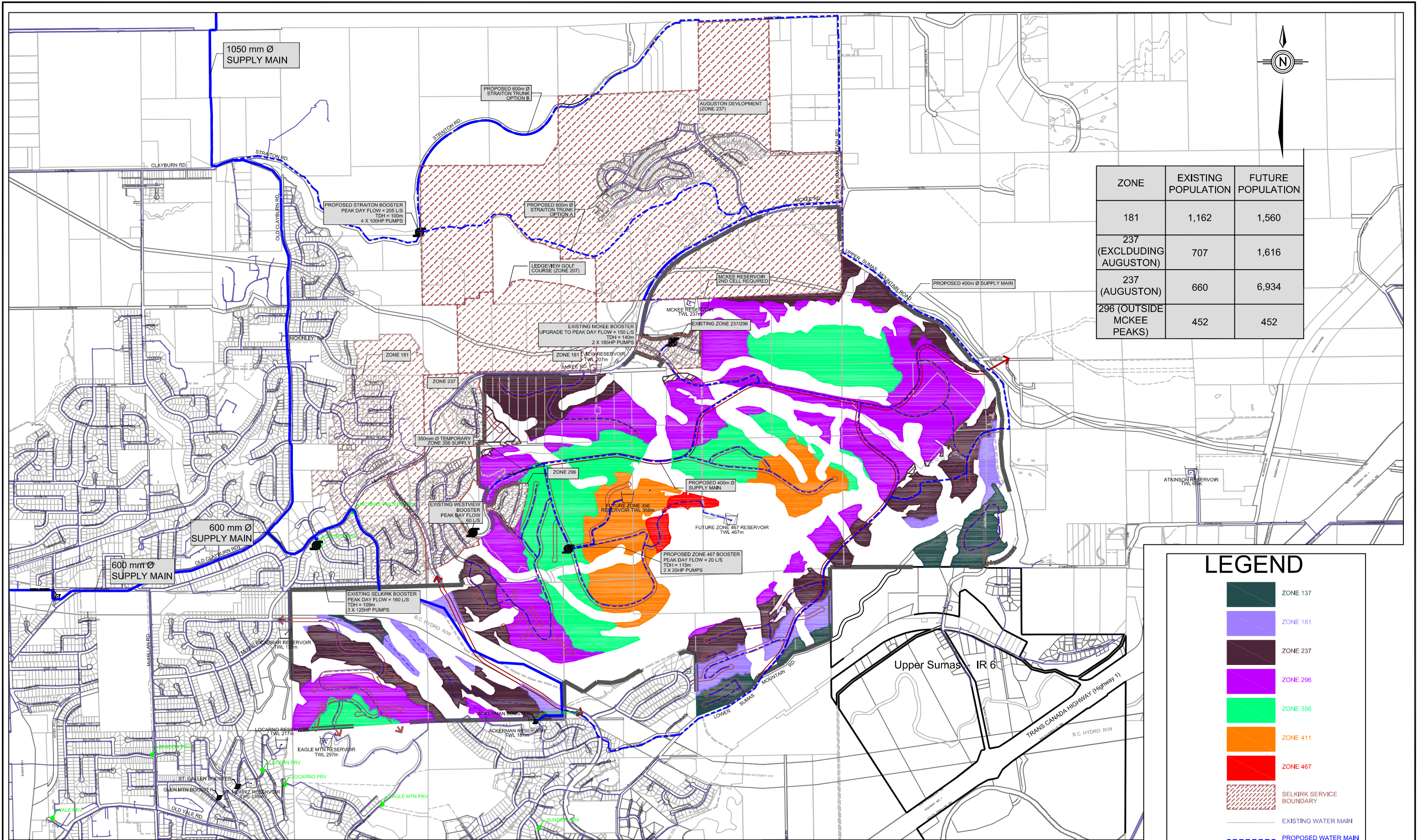
Both options are through difficult, environmentally sensitive terrain. Option B may be easier to construct, although its length is longer. Route selection will require additional analysis, to be carried out at the detailed design phase.

For the purposes of this plan review, it has been assumed that Option A will be constructed.

### **McKee/Sumas Mountain Road Water Main**

The McKee/Sumas Mountain Road 400mm water main begins at the terminus of the proposed 600mm Straiton Trunk and flows 925m to McKee Reservoir. A second branch also flows from the same location east to Upper Sumas Mountain Road. It then runs southeast along Upper Sumas Mountain Road and services the south side of McKee Peak. It is proposed that this water main also connect to the Ackerman Reservoir, in order to provide another source to fill the reservoir. The length of the second branch is 5,950m.





ZONE	EXISTING POPULATION	FUTURE POPULATION
181	1,162	1,560
237 (EXCLUDING AUGUSTON)	707	1,616
237 (AUGUSTON)	660	6,934
296 (OUTSIDE MCKEE PEAKS)	452	452

### LEGEND

- ZONE 137
- ZONE 181
- ZONE 237
- ZONE 296
- ZONE 356
- ZONE 411
- ZONE 467
- SELKIRK SERVICE BOUNDARY
- EXISTING WATER MAIN
- PROPOSED WATER MAIN

## MCKEE PEAK STUDY PROPOSED WATER SERVICING CONCEPT

NOTE - THE PRESSURE ZONES SHOWN ARE PRELIMINARY, BASED ON AVAILABLE CONTOUR INFORMATION. FINAL ZONE BOUNDARIES ARE TO BE DETERMINED DURING THE DETAILED DESIGN PHASE IN CONSULTATION WITH THE CITY.

FIGURE 12  
SCALE 1:20,000

### McKee Reservoir Additional Cell

It is estimated that the total population in Zone 237 and Zone 181 (those portions pressure reduced from Zone 237) will be 14,500 (both within and outside the McKee Peak Plan Area). The existing McKee Reservoir cell can service a population of approximately 8,000 persons. Therefore, an additional cell is required to service the remaining 6,500 persons.

The preliminary sizing of this reservoir is based on balancing 20% of peak day demands. Fire flow is already provided for in the existing cell. The reservoir sizing is as follows:

- |  |                  |
|--|------------------|
| • Fire Flow Requirements (already supplied in existing cell) | N/A              |
| • Balancing Requirements (6,500 persons)                     | 2,250,000 Litres |
| • Total  | 2,250,000 Litres |

### Zone 356 Reservoir

It is estimated that the total population to be serviced in Zone 356 and 296 (pressure reduced from 356) will be 7,185 (say, 7,200), based on 197.8 ha of developable area within the two pressure zones.

The preliminary sizing of this reservoir is based on balancing 20% of peak day demands, plus a fire flow of 120 L/s for a duration of 2 hours (multiple family uses). The reservoir sizing is as follows:

- |  |                  |
|--|------------------|
| • Fire Flow Requirements (120 L/s for 2 hours) | 864,000 Litres   |
| • Balancing Requirements (7,200 persons)       | 2,455,200 Litres |
| • Total  | 3,500,000 Litres |

### Zone 356 Supply Main

The Zone 356 Supply Main will transport water from the McKee Booster Station to the Zone 356 Reservoir. It is proposed to be a 400mm water main, with a total length of 3,300m.

### Upgrade McKee Booster Station

In order to boost water from Zone 237 to the Zone 356 reservoir, upgrades to the McKee Booster Station will be needed. Currently, the booster is equipped with two 5HP duty pumps and a 60HP fire pump to supply development in Zone 296. The station was designed to ultimately boost up to Zone 356 Reservoir, and was built with two empty pump cans to be able to achieve this.

Ultimate improvements to the station include:

- Replace the two existing 5HP duty pumps with 2-200HP pumps each capable of discharging 75L/s at 140m TDH
- Add additional stages to the fire pump, and replace the motor to be 200HP to match the two duty pumps, thereby providing 50% backup for peak day.



### Zone 467 Reservoir

The Zone 467 Reservoir will be designed to provide peak flow balancing and fire flows for Zones 467 and 411 (pressure reduced from Zone 467). It is estimated that the total population to be serviced in the two pressure zones will be 1,555 based on 42.8 ha of developable area within the two pressure zones.

The preliminary sizing of this reservoir is based on balancing 20% of peak day demands, plus providing for fire flow of 120 L/s for a duration of 2 hours (multiple family). The reservoir sizing is as follows:

- |  |                  |
|--|------------------|
| • Fire Flow Requirements (120 L/s for 2 hours) | 864,000 Litres   |
| • Balancing Requirements (for 1,555 persons)   | 530,000 Litres   |
| • Total  | 1,500,000 Litres |

### Zone 467 Booster

The Zone 467 Booster will be designed to boost the water from Zone 356 to Zone 467. Ultimate requirements of this pump station include:

- Construct pump station with two 40HP pumps capable of discharging 16L/s at 120m TDH to provide peak day flows
- Provide an additional 40HP pump for 50% backup.

### Ackerman Booster / Reservoir

It is understood that the City has reviewed the Ackerman Booster station records and has concluded that there is sufficient capacity in the booster to fill supply the Vicarro Ranch property on the south side of the BC Hydro ROW.

It is proposed to service the Vicarro Ranch property with the Ackerman Booster, and Eagle Mountain Reservoir. Improvements to the City (formerly FVRD) supply to maintain the HGL at Ackerman are required.

### Eagle Mountain Reservoir

It is understood that the City has reviewed the Eagle Mountain Reservoir records and has concluded that there is sufficient volume in the reservoir to service the Vicarro Ranch development south of the B.C. Hydro R.O.W.

An additional booster from the Eagle Mt. Reservoir will be required c/w fire pump and stand by power to service zone 356 in the Vicarro Ranch development.

### 7.2.7 City (Formerly FVRD) Supply Improvements

The McKee Peak developments will produce a significant demand on the City supply system. Upgrades to the supply system will be required not only to service the McKee Peak area but the balance of the City as well. The 2002 update of the FVRD Water Master Plan outlines improvements to the system required to meet the regional demands. Of these improvements, the ones that will be most beneficial to the plan area are those that increase the HGL at Ackerman reservoir including:



- Twinning the supply main from Norrish
- Additional wells in the Marshall Area

The Vicarro Ranch lands south of the BC Hydro right of way can not be developed until regional improvements are undertaken that maintain an adequate HGL at the Ackermjimaan reservoir.

It is understood that the City is investigating additional options for providing water to Abbotsford other than those identified in the FVRD Water Master Plan (2002), such as installing a regional booster station on the north side of the Fraser River to boost peak flows.

### 7.2.8 Interim Improvements

It is understood that the City has a commitment to supply the Auguston Development with water up to its planned population of approximately 6,900 persons. Currently, the population in Auguston is estimated at 660 persons.

If the full Auguston build out population is assumed to be committed then the remaining available service capacity of Selkirk Booster can accommodate a total serviceable population of approximately 3,300.

There is currently an existing population of approximately 2,321 serviced by the Selkirk Booster. This would result in a remaining capacity in Selkirk Booster for approximately 979 persons within the McKee Peak Plan Area. If the suction HGL is raised by 17m at the Selkirk Booster, an additional 1,800 persons can be accommodated within the McKee Peak Plan Area.

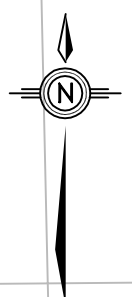
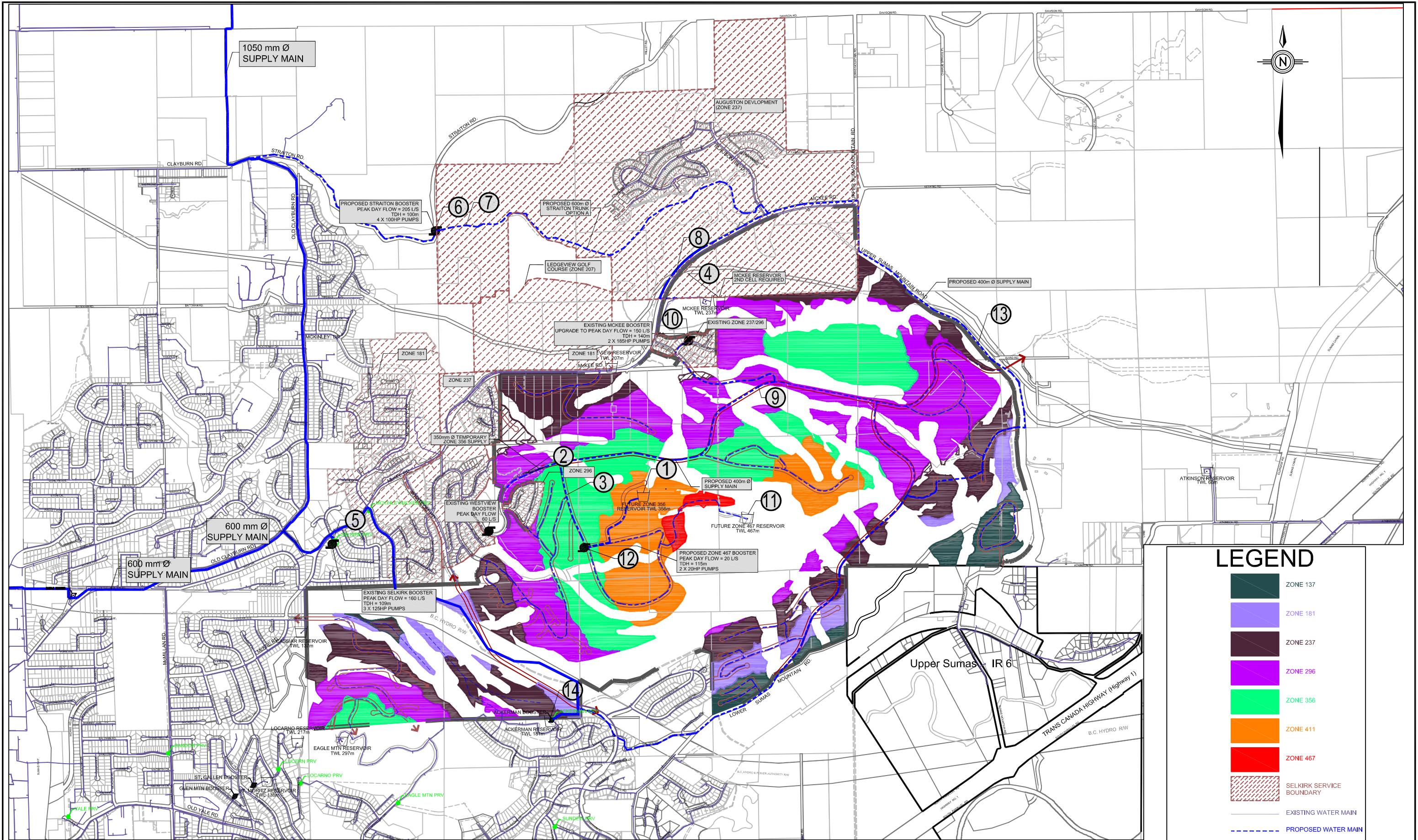
To allow for this population, it is recommended that the design and construction of the Zone 356 reservoir be carried out, and a temporary connection made to the reservoir from the temporary booster located on Westview Blvd.

The following improvements are required for this option:

- Construction of 350m of 350mm diameter water main from the terminus of the existing 350mm water main from the temporary Westview Booster to the proposed 400mm Zone 356 Supply Main
- Pump station upgrades, including the installation of two new 60 hp pumps
- Construct 1,025m of 400mm Zone 356 supply main from the terminus of the proposed 350mm main to the Zone 356 reservoir
- Construct the Zone 356 Reservoir

### 7.2.9 Summary

A summary of each improvement with its trigger population is presented in the table below. The population triggers *include existing zones outside the plan area* that are serviced from Selkirk Booster. Depending on the actual spatial location of development, these triggers may change. These improvements are shown on Figure 13.



**LEGEND**

- ZONE 137
- ZONE 181
- ZONE 237
- ZONE 296
- ZONE 356
- ZONE 411
- ZONE 467
- SELKIRK SERVICE BOUNDARY
- EXISTING WATER MAIN
- PROPOSED WATER MAIN

**MCKEE PEAK STUDY**  
**EXISTING NETWORK AND PROPOSED UPGRADES**

NOTE - THE PRESSURE ZONES SHOWN ARE PRELIMINARY, BASED ON AVAILABLE CONTOUR INFORMATION. FINAL ZONE BOUNDARIES ARE TO BE DETERMINED DURING THE DETAILED DESIGN PHASE IN CONSULTATION WITH THE CITY.



**Table 7-8 - Summary of Each Improvement with Trigger Population\***

Improvement	Population Trigger
1. Construct Zone 356 Reservoir	Immediately for proposed development above Zone 237
2. Construct 350mm temporary booster connection to proposed 400mm Zone 356 Supply Main and upgrade temporary booster.	Immediately for proposed development above Zone 237
3. Construct a portion of 400mm Zone 356 Supply Main	Immediately for proposed development above Zone 237
4. Construct additional 3ML McKee Reservoir cell	8,000
5. Close Selkirk connection to Zone 137 and raise Selkirk PRV Setting	10,200
6. Construct Straiton Booster	12,000
7. Construct Straiton Trunk	12,000
8. Construct McKee Trunk	12,000
9. Construct Zone 356 Supply Main	16,000
10. Upgrade McKee Booster Station	16,000
11. Construct Zone 467 Reservoir	22,500
12. Construct Zone 467 Booster	22,500
13. Sumas Mountain Trunk	When development occurs at Upper Sumas Mtn Road
14. FVRD Improvements	Immediately for development in Vicarro Ranch south of BC Hydro ROW

\*The exact order for the each upgrade is based on the spatial location of development, and an upgrade with a higher population trigger may be required before one with a lower population trigger. For example, the 10,200 population trigger for upgrades to the Selkirk pump station may be reached before the 8,000 population trigger to construct the second McKee reservoir cell. This is because the 8,000 population trigger is only for those in zones 237 and 181, while the 10,200 will take into account demand from Zones 181 and above. It is recommended that the City monitor the population in each zone as development progresses to determine which upgrades will be required first.

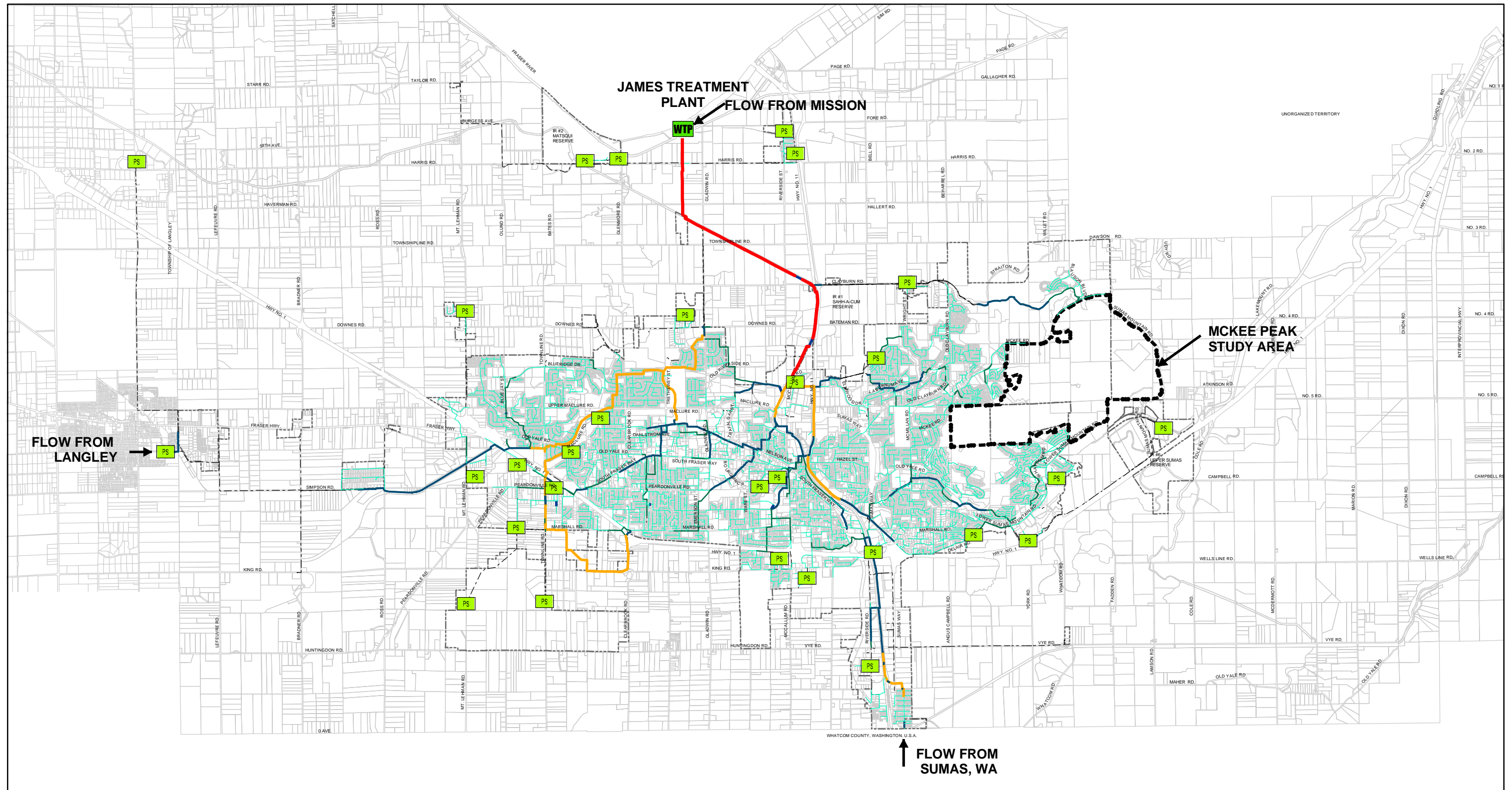
## 7.3 Sanitary Servicing

### 7.3.1 Introduction

On a regional basis, sanitary wastewater from the City of Abbotsford is treated at the Joint Abbotsford - Mission Environmental System (J.A.M.E.S.) Water Pollution Control Center. The location of the J.A.M.E.S. plant and the current sanitary sewer service boundary is illustrated in Figure 14.

The J.A.M.E.S. plant treats wastewater from the City of Abbotsford, Mission, the community of Aldergrove in the Township of Langley and the City of Sumas, Washington.





# MCKEE PEAK STUDY

## FIGURE 14

### SANITARY SEWER SYSTEM OVERVIEW

- Gravity Sewers
  - < 300 mm
  - 300 - 375 mm
  - 400 - 600 mm
  - 675 - 1050 mm
  - < 1050 mm
- Forcemains/Siphons
- Existing Sewer Boundary
- PS Lift Station



77.14

SCALE 1:75,000

Drawn By: Joel McAllister

October 2005

The development stages and design population equivalent are provided in Table 7-9 as follows:

**Table 7-9 - Development Stages and Associated Populations  
J.A.M.E.S. Water Pollution Control Center**

Stage	Design Population Equivalent
I and II	80,000
III and IV	160,000
V and VI	240,000
Ultimate	480,000

Dayton & Knight Ltd. has been involved with all phases of Stages I through VI implementation.

The present contributing residential population is approximately 165,000. Maximum day flows are currently 80,000+ m<sup>3</sup>/day. With the new outfall constructed in 2004, the present approved discharge is 122,600 m<sup>3</sup>/day.

Wastewater generated from the McKee Peak Plan Area will be conveyed through the City of Abbotsford's distribution system into the CPR and JAMES Trunks where it will be treated at the J.A.M.E.S plant.

The CPR Trunk is generally a 1650mm diameter gravity sanitary trunk main originating near Clayburn Road and Highway 11. This trunk main flows northwest paralleling the Southern Rail of BC (S.R.B.C.) rail lines toward Gladwin Road. At the confluence of the CPR Trunk and the Clearbrook Trunk main at Gladwin Road the trunk is called the JAMES Trunk, which is a 1800mm diameter gravity sewer that terminates at the J.A.M.E.S. treatment plant.

The CPR Trunk has capacities ranging between 665 and 2,672 L/s.

The JAMES Trunk is a 1800mm (except for 25m of 1500mm and 60m of 1350mm pipe) pipe with capacities ranging between 978 and 3,956 L/s.

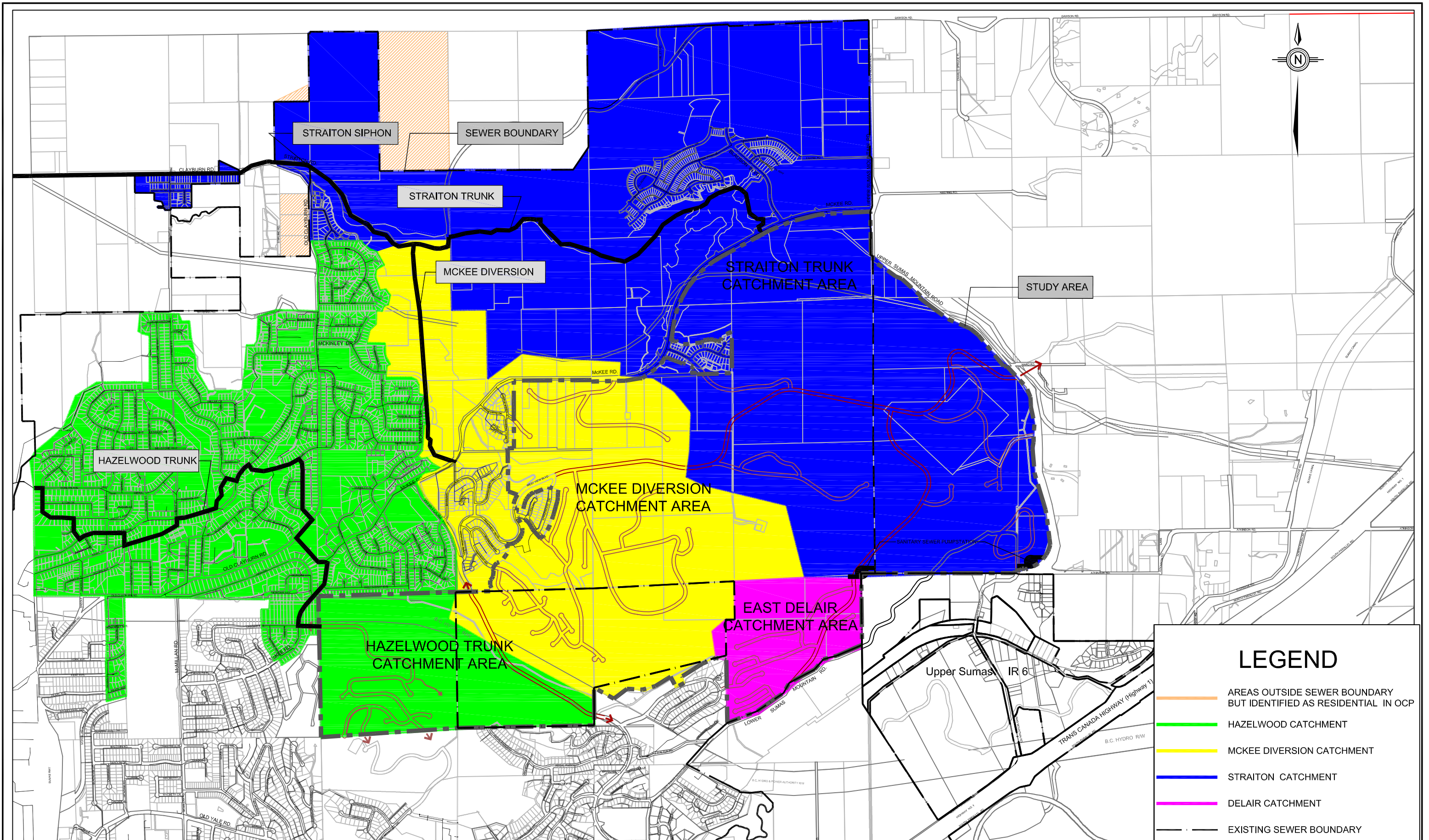
The McKee Peak Planning area is generally comprised of four sanitary catchment areas listed as follows and illustrated in Figure 15:

- Hazelwood
- McKee
- Straiton
- Delair

Sanitary flows from the four major McKee Peak catchment areas are conveyed by the local collector sewers into City of Abbotsford main trunk sanitary sewer mains including the Hazelwood Trunk, the McKee Diversion, the Straiton Siphon, the Straiton Trunk and the East Delair pump station.

The Hazelwood Trunk sewer originates at McKee Road/Cassiar Avenue and conveys flows along Laburnum Avenue to Hazelwood Avenue where it discharges to the CPR Trunk at Highway 11. The Hazelwood trunk consists generally of gravity sanitary sewer pipes ranging in size between 200mm diameter at the upper end to 600mm diameter where it connects into the CPR Trunk.





MCKEE PEAK STUDY  
 MAJOR SANITARY TRUNKS AND CATCHMENTS

FIGURE 15  
 SCALE 1:20,000



The McKee diversion is a 400mm diameter sewer main constructed in 2004 to relieve flows on the Hazelwood trunk. The McKee diversion originates at McKee Road near Westview Drive and conveys flows north toward Clayburn Road.

The Straiton Siphon consists of two separate sewers including a 450mm diameter main and a 300mm diameter backup main. The Straiton Siphon collects flows from the Straiton Trunk and the McKee diversion and conveys flows west along Old Clayburn Road toward Highway 11 where it connects into the CPR Trunk.

The Straiton Trunk sewer was constructed for the Auguston development located north of McKee Road and consists generally of 450mm diameter PVC gravity sanitary sewers located within a right of way that convey flows to Clayburn Road and the Straiton Siphon.

The Delair system comprises local collector gravity sanitary sewers that convey flows along Whatcom Road to the East Delair pump station located on Delair Road. The East Delair pump station then pumps wastewater via a forcemain toward the west and ultimately into the CPR Trunk.

**Context**

The sewage flows for the study area were calculated from delineated sub-catchment areas and assigned to key nodes. These nodal flows were then analyzed using Pizer’s HYDRA sewer model. All model runs were carried out by Kerr Wood Leidal Associates Ltd. Each model run included an analysis using the Hydra software and using a Babbitt analysis.

**7.3.2 Previous Sewer Studies**

Previous sewer studies have been completed for various portions of the Abbotsford Sewer System, including the McKee Peak Plan Area. These include:

- East Langley/West Abbotsford Sanitary Sewer Study – Dayton & Knight, 2005
- Vicarro Development Analysis Memo – Kerr Wood Leidal Associates Ltd., 2004
- 2002-2003 Update of Wastewater Master Plan - Dayton & Knight, 2003

**7.3.3 Current Development Standards**

The current development standards for sanitary sewers are contained within the City’s Subdivision and Development Bylaw No. 1125-2002. The design criterion includes base flow data, peaking factors, infiltration factor, and population densities.

The base flow used in the analysis was 350 litres per capita per day (lpcpd). The peaking factors used were from the Babbitt Curve. Populations were calculated from population densities shown in Table 7-10.

**Table 7-10 - Land Use Population Densities.**

Land Use	Population Density
Low Density ( $\leq 16$ units per ha)	3.3 persons per dwelling
Medium Density ( $\geq 16$ and $\leq 45$ units per ha)	2.5 persons per dwelling
High Density ( $> 45$ units per ha)	1.8 persons per dwelling
Institutional	54 persons/ha
Commercial	86 persons/ha
Industrial	50 persons/ha

### Variations from Current Development Standards

Trunk sewers, defined as sewer mains with no service connections, were analyzed using the Hydra software, which gives a more accurate analysis for larger catchment areas than the Babbitt formula. Typically, trunk sewers are mains greater than 400 mm in diameter.

#### 7.3.4 Sewer Sub-Catchments

The four separate sanitary catchment areas for the McKee Peak plan area (Hazelwood, McKee Diversion, Straiton, and East Delair) were delineated into sub-catchments based on contours, major road networks and the apparent most likely gravity sanitary sewer alignments.

The peak flow rates from each of the sub-catchment areas were calculated based on the criterion stated previously and summed to the point of the corresponding major trunk outlet.

Each of these sub-catchments including area, and calculated flow rate is summarized in Table 7-11, and illustrated in Figure 16.

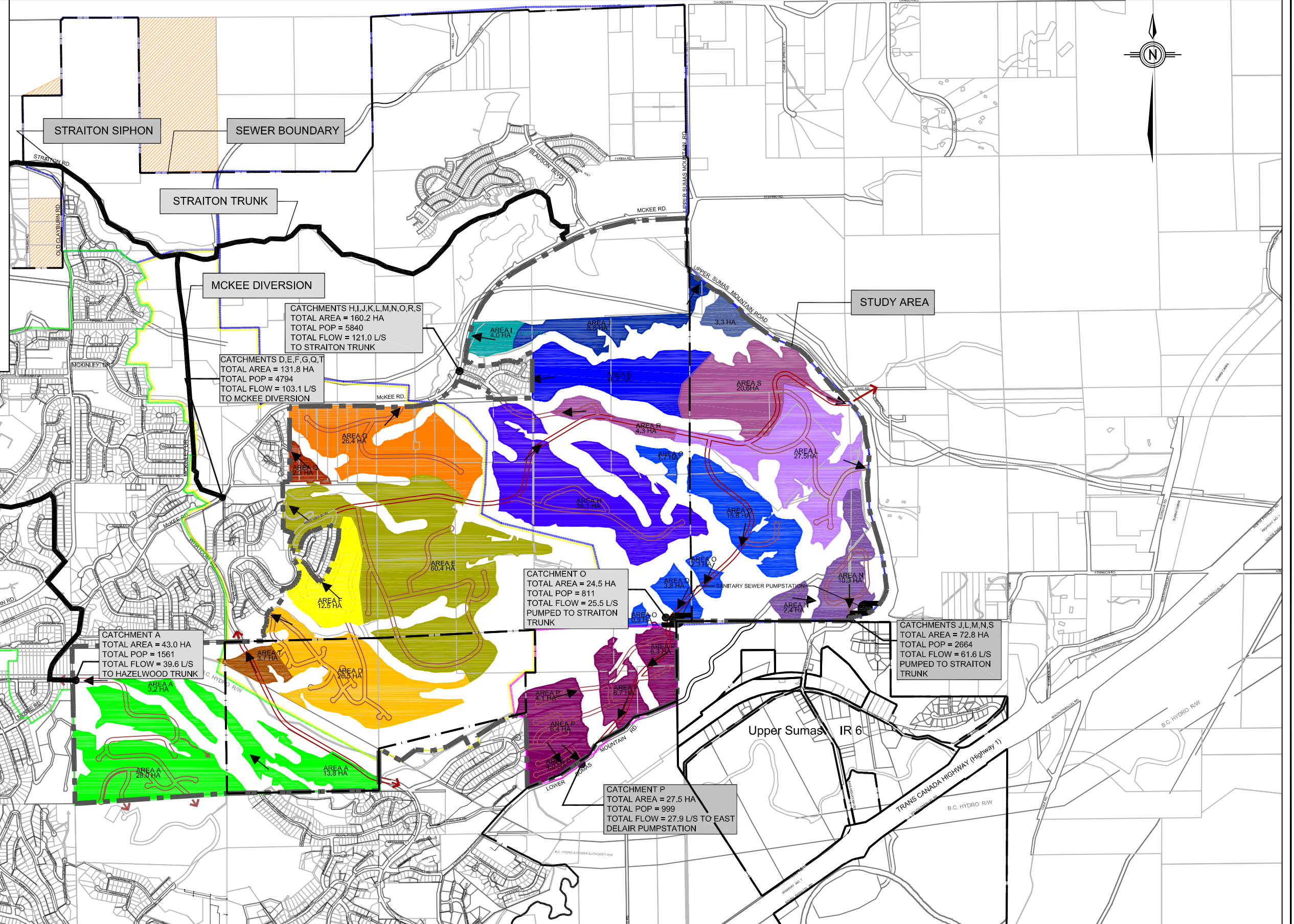
**Table 7-11 - Sanitary Sewer Catchments**

Catchment	Sub-Catchment	Area (ha)	Flow (L/s)
Hazelwood	A	43	39.6
<b>Total Hazelwood</b>		<b>43</b>	<b>39.6</b>
McKee Diversion	D	26.5	27.4
	E	60.4	53.4
	F	12.5	13.1
	G	26.4	28.7
	Q	2.3	2.4
	T	3.7	3.9
<b>Total McKee Diversion</b>		<b>131.8</b>	<b>103.1</b>
Straiton	H	36.1	32.1
	I	4.0	4.1
	J*	8.8	9.2
	K	18.4	3.5
	L*	27.5	28.4
	M*	3.3	2.9
	N*	12.7	13.4
	O*	24.5	25.5
	R	4.3	4.6
	S*	20.6	21.7
<b>Total Straiton</b>		<b>160.2</b>	<b>121.0</b>
East Delair	P	27.5	27.9
<b>Total East Delair</b>		<b>27.5</b>	<b>27.9</b>

\* These catchments will require lift stations.

There are several catchments on the south side of the study area which will require pumping to flow into the Straiton Trunk Sewer (Catchments J, L, M, N, O, and S). There is significant lift required to overcome the static head, and will likely require multiple stations pumping in series.

SANITARY SEWER CATCHMENT AREA	AREA (HA)	POPULATION	FLOW (L/S)
A	43.0	1561	39.6
D	26.5	964	27.4
E	60.4	2195	53.4
F	12.5	455	13.1
G	26.4	959	28.7
H	36.1	1312	32.1
I	4.0	146	4.1
J	8.8	320	9.2
K	18.4	668	3.5
L	27.5	1000	28.4
M	3.3	130	2.9
N	12.7	463	13.4
O	24.5	891	25.5
P	27.5	1009	27.9
Q	2.3	85	2.4
R	4.3	159	4.6
S	20.6	751	21.7
T	3.7	136	3.9



2005-04-26

**MCKEE PEAK STUDY**  
**SANITARY SEWER SUB-CATCHMENTS AND DESIGN FLOWS**



### 7.3.5 Major Trunk Sewers

The flows generated from the individual sub-catchment areas were entered into the City's sanitary sewer Hydra model at key locations in the existing sanitary sewer network to assess the impact to the existing system.

Two separate sanitary sewer models were developed to assess the impact of the additional flows generated from the McKee Peak plan area. The first analysis was undertaken with the current OCP build-out, while excluding the McKee Peak Plan Area and the second analysis was undertaken with the current OCP build-out, including the additional flow from the McKee Peak Plan Area. The improvements identified in the model as a result of the additional contribution from the McKee Peak Plan Area were then identified.

#### Hazelwood Catchment

The Hazelwood Catchment services the existing properties up to Whatcom Road. The majority of this catchment is outside the McKee Peak study, and the total flow at the outlet of this catchment, both before and after the McKee Peak study flows are tabulated in Table 7-12.

**Table 7-12 - Hazelwood Trunk Sewer Flows**

Condition	Area (ha)	Population	Flow (L/s)
OCP Build-out without McKee Peak contributing	408.5	15,358	247.3
OCP Build-out with McKee Peak contributing	451.5	16,919	272.5

#### McKee Diversion Catchment

The McKee Diversion was constructed in 2004, and is currently not in service. However, it is expected to be in service in 2005. This catchment will carry a significant portion of the flows from the McKee Peak Plan Area. In addition, it will carry flows from the existing "Highlands" and "Ledgeview Estates" subdivisions.

The McKee Diversion ultimately discharges into the Straiton Siphon, which flows west along Old Clayburn Road to Highway 11, at which point it discharges into the CPR Trunk. The catchment characteristics, both excluding and including the McKee Peak Plan Area, are shown in Table 7-13.

**Table 7-13 - McKee Diversion Sewer Flows**

Condition	Area (ha)	Population	Flow (L/s)
OCP build-out without McKee Peak contributing	66.0	3,073	60.4
OCP build-out with McKee Peak contributing	197.0	7,867	158.6

#### Straiton Catchment

The Straiton Trunk Sewer was installed in 1996 for servicing the Auguston Development. It is a 375/450mm trunk sewer with capacities ranging from 300 L/s to 1,270 L/s.

This will be the largest catchment in the McKee Peak study area, servicing a population of 5,840 people in the McKee Peak Plan Area as well as 9,450 persons outside the McKee Peak Plan Area. Its total service population will be 15,290 persons.

The catchment characteristics, both excluding and including the McKee Peak area are shown in Table 7-14.

**Table 7-14 - Straiton Trunk Sewer Flows**

Condition	Area (ha)	Population	Flow (L/s)
OCP Build-out without McKee Peak contributing	300.0	9,450	180.7
OCP Build-out with McKee Peak contributing	460.0	15,290	308.5

**East Delair Catchment**

The East Delair Catchment is near its capacity under existing conditions, and it is important that little additional flows be added to the catchment. Therefore, all flows that would have flowed by gravity to the Delair system are proposed to be routed through two future sanitary sewer pump stations at the south-end of the plan area, through to the Straiton Trunk.

The total flow from the McKee Peak Plan Area through the Delair catchment is 26.4 L/s. The population from the McKee Peak Plan Area in the Delair catchment is 999 persons.

**7.3.6 Long-Range Improvements**

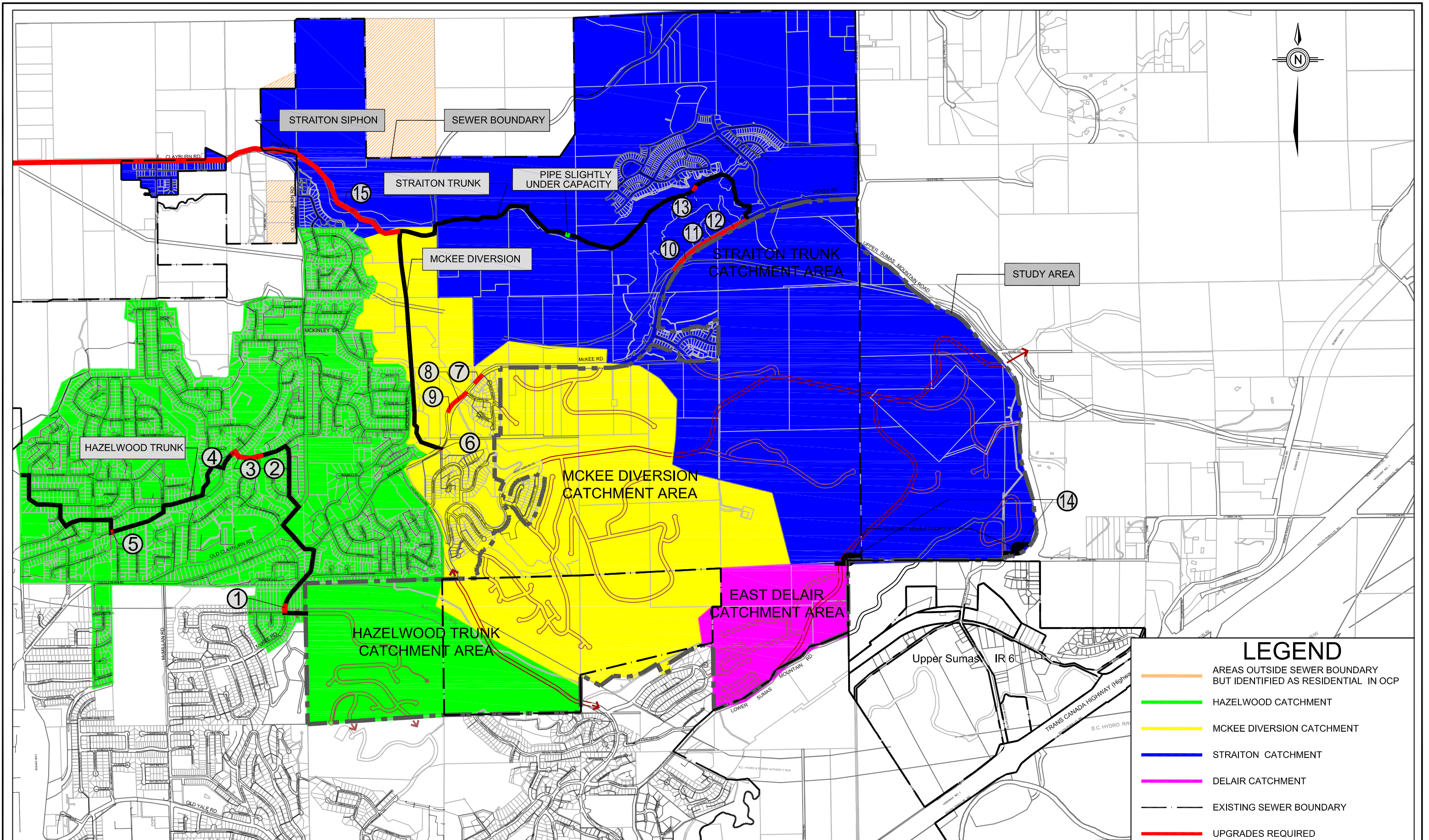
Long-range improvements will be required to service the McKee Peak Plan Area. These improvements, with the exception of the Straiton Siphon, are relatively small sections of pipe to be upgraded or replaced. These improvements, shown in Figure 17, are broken down into four separate sections:

- Hazelwood Catchment Improvements
- McKee Diversion Catchment Improvements
- Straiton Catchment Improvements
- Straiton Siphon Improvements

There will also be local upgrades that will be required. These will depend on the proposed collector sewer locations, and should be evaluated during detailed design.

**Hazelwood Catchment Improvements**

Hazelwood Catchment improvements are required to service the Vicarro Ranch property west of the BC Hydro right of way. These improvements are required to increase the capacity of the existing sewer, and are summarized in Table 7-15.



MCKEE PEAK STUDY  
 MAJOR SANITARY TRUNKS AND REQUIRED UPGRADES

FIGURE 17  
 SCALE 1:20,000



**Table 7-15 - Existing Pipe Deficiencies and Recommended Upgrades  
Hazelwood Catchment**

Improvement	Existing Capacity (L/s)	Required Capacity (L/s)	Deficiency (L/s)	Recommended Upgrade Size (mm)
1. Upgrade 55m of existing 200mm pipe on McKee Rd. north of Cassiar Ave.	37.0	50.9	13.9	300
2. Upgrade 30 m of 200 mm pipe west of the end of Skeena Avenue	65.2	103.2	38.0	300
3. Upgrade 48 m of 200 mm pipe downstream of above improvement	57.7	108.3	50.6	300
4. Upgrade 68 m of 200 mm pipe downstream of above improvement	38.0	108.3	70.3	375
5. Upgrade 33 m of 300 mm pipe downstream of above improvement	95.4	108.4	13.0	375
6. Upgrade 30 m of 300 mm pipe downstream of above improvement	87.8	109.4	21.6	375
7. Upgrade 16 m of 450 mm pipe on Immel Road approximately 120 m east of Mierau Street	70.5	133.3	96.0	600

**McKee Diversion Catchment Improvements**

McKee Diversion Catchment improvements are required to service portions of the McKee Peak Planning Area. These improvements are required to increase the capacity of the existing sewer, and are summarized in Table 7-16.

**Table 7-16 - Existing Pipe Deficiencies and Recommended Upgrades  
McKee Diversion Catchment**

Improvement	Existing Capacity (L/s)	Required Capacity (L/s)	Deficiency (L/s)	Recommended Upgrade Size (mm)
1. Upgrade 11 m of 200 mm pipe on McKee Road approximately 245m northeast of Whatcom Road (for sub-catchment E)	20.1	54.9	34.8	375
2. Upgrade 71 m of 250 mm pipe on McKee Road approximately 70m northeast of Ledgview Dr. (for sub-catchments G,Q)	37.3	41.7	4.4	300
3. Upgrade 23 m of 250 mm pipe on McKee Road southeast of Ledgeview Dr (for sub-catchments G,Q)	30.5	44.4	13.9	375
4. Upgrade 81 m of 250 mm pipe downstream of above improvement (for sub-catchments G,Q)	33.1	44.4	11.3	375
5. Upgrade 34 m of 250 mm pipe downstream of above improvement (for sub-catchments G,Q)	37.2	44.4	7.2	375
6. Upgrade 29 m of 250 mm pipe downstream of above improvement (for sub-catchments G,Q)	40.4	44.4	4	300

### Straiton Catchment Improvements

Straiton Catchment improvements are required to service the sub-catchments D-G, Q, and T. These improvements are required to increase the capacity of the existing sewer, and are summarized in Table 7-17.

**Table 7-17 - Existing Pipe Deficiencies and Recommended Upgrades  
Auguston Catchment**

Improvement	Existing Capacity (L/s)	Required Capacity (L/s)	Deficiency (L/s)	Recommended Upgrade Size (mm)
1. Upgrade 46 m of 200 mm pipe on McKee Road approximately 400m north of Buckingham Dr (for sub-catchments H-O,R,S)	68.9	127.8	58.9	300
2. Upgrade 88 m of 200 mm pipe downstream of above improvement (for sub-catchments H-O,R,S)	78.5	143.8	65.3	300
3. Upgrade 100 m of 200 mm pipe downstream of above improvement (for sub-catchments H-O,R,S)	86.0	148.1	62.1	300
4. Upgrade 52 m of 200 mm pipe downstream of above improvement (for sub-catchments H-O,R,S)	61.5	153.8	92.3	375
5. Upgrade 78 m of 200 mm pipe downstream of above improvement (for sub-catchments H-O,R,S)	50.2	153.8	103.6	375
6. Upgrade 71 m of 200 mm pipe downstream of above improvement (for sub-catchments H-O,R,S)	31.4	153.8	122.4	450
7. Upgrade 90 m of 200 mm pipe downstream of above improvement (for sub-catchments H-O,R,S)	31.6	155.4	123.9	450
8. Upgrade 36 m of 375 mm pipe in the Straiton Trunk sewer	253.0	291.7	38.7	450
9. Construct two new sanitary lift stations to service the south side of McKee Peak	N/A	N/A	N/A	N/A

There is a 27 m portion of the 450 mm Straiton Trunk sewer that is slightly under capacity, and is identified in Figure 17. This section of pipe is less than 2% under capacity, and will not likely require upgrading.

### Straiton Siphon

The upgrade to the Straiton Siphon will be the largest upgrade for servicing the McKee Peak Plan Area. Currently, there are parallel 450mm and 300mm siphons, with capacities of 303 L/s and 99L/s respectively. Ultimately, both the McKee Diversion and the Straiton Trunk discharge into the Straiton Siphon.

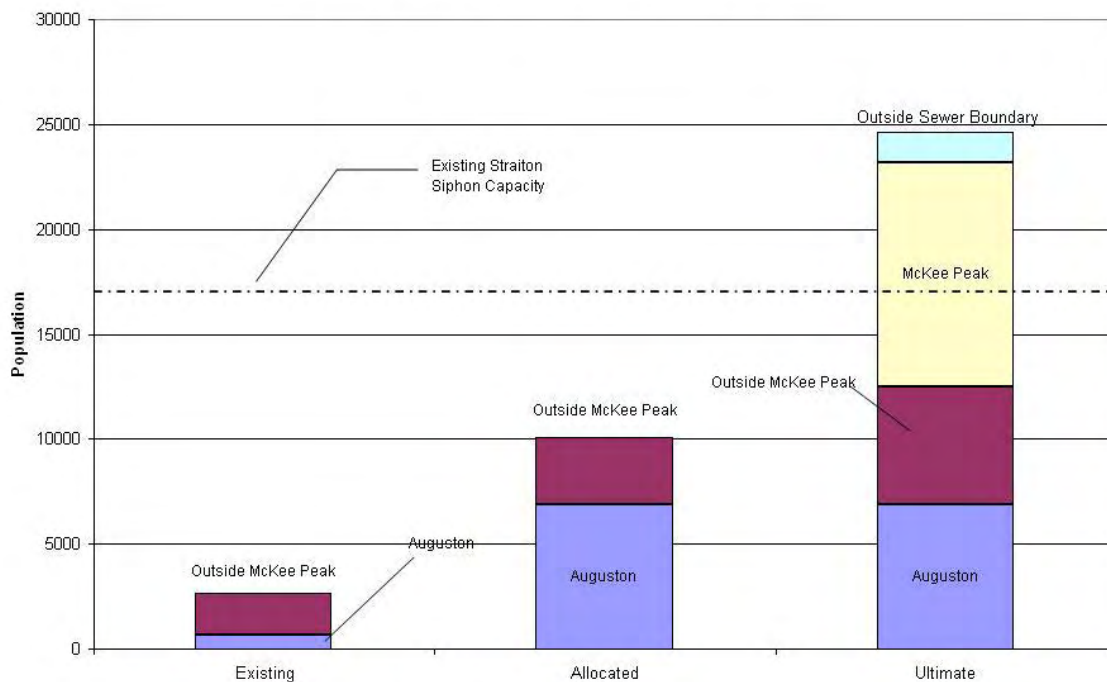
It is the City's policy to not rely on the additional capacity in the smaller siphon, due to operational requirements and for system redundancy. As this siphon parallels Clayburn Creek, a fisheries sensitive watercourse, it is desirable to have the additional capacity for system redundancy, and not rely on the smaller pipe to form a portion of the design flow capacity.

The existing 450mm siphon has a capacity of 303 L/s. This corresponds to a population of approximately 17,000 persons. The total service population for the siphon is estimated as follows:

- Population outside the plan area but within the sewer boundary 12,523
- Population outside the plan area and the sewer boundary 1,500
- Population within the plan area 10,634
- Total 24,657

The required ultimate capacity is 460.3 L/s, which results in a deficiency of approximately 158 L/s. This deficiency will need to be addressed in order to service the remaining 7,657 persons. This is shown graphically in Figure 18.

**Figure 18 – Existing, Allocated and Ultimate Populations**



In order to address this deficiency, the 450mm pipe will need to be upgraded to a 600mm equivalent. Depending on the timing of the development, the existing pipe could either be twinned or replaced. For the purposes of this report, it is assumed that the pipe will be replaced.

**7.3.7 Summary**

A summary of each improvement with its trigger population and cost estimate is presented in Table 7-18. Note that the population triggers are including existing zones outside the Plan Area that are serviced by each of the trunk sewers. Depending on the actual spatial location of development, these triggers may change.



**Table 7-18 - Summary of Improvements, Population Trigger**

Improvement	Catchment	Corresponding Improvement from Table 7-14/ 7-15/ 7-16	Population Trigger
1. Upgrade 55 m of 200 mm to 300 mm pipe on McKee Road, just north of Cassiar Avenue	Hazelwood	1	2,000
2. Upgrade 78 m of 200 mm to 300 mm pipe west of the end of Skeena Avenue		2-3	2,800
3. Upgrade 101 m of 200/300 mm to 375 mm pipe downstream of above improvement		4-5	Immediately
4. Upgrade 30 m of 300 mm to 375 mm pipe downstream of above improvement		6	5,000
5. Upgrade 16 m of 450 mm to 600 mm pipe on Immel Road approximately 120 m east of Mierau Street		7	3,500
6. Upgrade 11 m of 200 mm pipe on McKee Road approximately 245m northeast of Whatcom Road	McKee Diversion	1	1,100
7. Upgrade 71m of 250mm with 300mm pipe on McKee Road approximately 245m northeast of Ledgeview Dr		2	1,500
8. Upgrade 138 m of 250mm to 375 mm pipe on McKee Rd downstream of above improvement		3-5	1,200
9. Upgrade 29 m of 250 mm to 300 mm pipe on McKee Rd downstream of above improvement		6	1,700
10. Upgrade 234 m of 200 mm to 300 mm $\emptyset$ sanitary sewer on McKee Road approximately 400m north of Buckingham Dr.	Straiton	1-3	3,100
11. Upgrade 130 m of 200 mm to 375 mm pipe downstream of above improvement		4-5	2,100
12. Upgrade 161 m of 200 mm to 450 mm pipe downstream of above improvement		6-7	1,200
13. Upgrade 36 m of 375 mm pipe in the Straiton Trunk sewer		8	14,000
14. Construct two new sanitary lift stations on south side of McKee Peak		9	When development on the south side of plan are occurs
15. Upgrade 3,337 m to 400 mm $\emptyset$ sanitary sewer siphon on Old Clayburn Road, from the Straiton sewer to Hwy 11	McKee Diversion and Straiton	N/A	17,000

# Part Four – McKee Peak Plan Policies and Recommendations

## 8.0 Plan Policies

### 8.1 Introduction

This section provides the policies and recommendation to allow implementation of the McKee Peak land use plan. They reflect land use information as well as associated transportation and utility components. The policies strive to retain an appropriate balance between environmental preservation and development. It ensures retention of the valued qualities of McKee Peak including the critical wildlife areas, the steep sloping bluffs and important natural areas. Residential use will be nestled in a series of development clusters surrounded by green space. Development clusters will in turn be consolidated into a variety of neighbourhoods which are expected to develop over several decades. With much of the eastern area likely to remain active with mining activity, this portion of McKee Peak is expected to remain unavailable for alternative development, potentially as long as 50 years. Planning for any necessary road and utility continuity should however be considered now, to ensure that this area is ultimately fully integrated with other McKee Peak development. In the interim the western portions of the McKee Peak area will need to be self sufficient for both road access and utilities since alignment requirements through the eastern portion of the site are long term at best.

Planning policies and recommendations are summarized in the following classifications:

- Residential and Neighbourhood Concept
- Design and Aesthetics
- Greenspace and Environmental
- Commercial
- Roads and Utilities
- Development Phasing and Financing

The relevant planning maps associated with this section follow at the end.

### 8.2 Plan Policies and Recommendations

The McKee Peak area has been divided into broad neighbourhood components, each of which is defined by significant riparian areas and/or segments of steep slopes. The allocation of neighbourhoods provides the basis for more detailed planning that follows local topographic and environmental features. The neighbourhood structure is illustrated on **Map Schedule 1 - Neighbourhood Areas**. Approximately six neighbourhoods are projected, with one neighbourhood constituting the majority of land now being mined. This projected neighbourhood is expected to be unavailable for alternative forms of development for a generation.

Land Uses within the McKee Peak area shall substantially conform to the broad land use designations illustrated on **Map Schedule 2 – Land Use Concept**. Some variation may however be permitted based on more detailed slope analysis, environmental studies, or geotechnical safety considerations. For example riparian and wildlife assessment areas illustrated on the maps may change as a result of field truthing, or in response to more detailed environmental review. Similarly, land use designations in the Clayburn Industries/Sumas Shale area are highly conceptual at this point, since on-going mining operations will



result in changes that will need to be reflected at such time as mining ceases. Appropriate plans shall be submitted by qualified professionals to document and justify any desired changes (e.g. riparian areas).

The following are plan policies and recommendations:

**Residential and Neighbourhood Concept**

- R 1        The developable areas of McKee Peak shall be in substantial compliance with the Neighbourhood designated areas as shown on *Map Schedule 1 Neighbourhood Areas*.
- R 2        The developable areas as shown on the *Neighbourhood Areas* map are intended to generally locate areas where residential and commercial land uses, as well as ancillary uses are to be located. The precise development boundaries are to be confirmed through field and topographic analysis and will depend also on the extent of riparian area and steep slopes.
- R 3        Where feasible and subject to anticipated population, each of the neighbourhood areas is to be provided with at least one neighbourhood park. It is acknowledged however, that each neighbourhood in itself will not in all cases be sufficiently large to support an elementary school.
- R 4        In order to minimize encroachment on very steep slopes residential development shall be limited to slopes of less than 40%.
- R 5        Where at least 50% of a development site is on property with grades in excess of 30%, housing within that development site shall consist of multiple family housing and/or cluster housing, where residential lots are clustered in one area of a larger parcel.
- R 6        Single family housing:
  - 1. Lot sizes are generally expected to be around 500 m<sup>2</sup>. The absolute minimum permitted lot size shall be 325m<sup>2</sup> (e.g. for single-family cluster housing).
  - 2. Lot depth shall be not less than 25 metres.
- R 7        Multiple family housing: The minimum permitted lot size for a multi family housing project shall be 2000 m<sup>2</sup>.
- R 8        In determining permitted densities, lands with slopes over 40%, and areas to be maintained as mandatory non-buildable areas such as required geotechnical setbacks are to be excluded from site area density and lot yield calculations. For setbacks resulting from environmental / fisheries requirements, applicable zoning density provisions are to be followed.
- R 9        The maximum building height shall be 4 storeys for an apartment building, and 3 storeys for a townhouse residential use.

In the proposed multi family area south of McKee Road at the Ledgeview golf course the maximum building height shall be limited to 8 storeys. The City may over the longer term consider buildings of up to 8 storeys in other locations, but only if such sites do not compromise the view quality for areas beyond the McKee Peak planning area (i.e. the buildings do not dominate the views over the mountain, and the buildings do not become prominent land marks as viewed from external areas).

R 10 There are community benefits associated with cluster housing which can result in added green space and reduced impervious areas that enhance storm water management. Cluster housing is permitted under the following circumstances:

1. The clustering of housing units allows the retention of green space/open space for at least 65% of the parcel.
2. The green space/open space contributes to ridgeline preservation, retains environmentally sensitive areas, or offers other broader community benefits.
3. The open space is acceptable to the City and is protected from development (including parking and driveways) by a covenant registered in favour of the City of Abbotsford, is purchased by the City, is held as a common strata lot, or is held in trust (e.g. Abbotsford Land Trust) as permanent open space.
4. Development of the property must allow for public access to the open space if the open space is identified on the *Land Use Concept* as part of a trail system, an access location to a view point, or natural feature such as a waterfall.
5. To encourage clustering of single family housing units the following will apply:
  - a. The permitted density of housing on the area remaining for development (after dedication or covenant registrations) shall be not less than that achievable without the covenant or dedication (also see item *b.* below). This clustering of housing units can be achieved by a reduction of individual lot sizes, or a change in building form (e.g. multiple family housing or apartments, however buildings shall be subject to height limitations in the earlier stated policies of this section).
  - b. Cluster development is to be considered only where the parent parcel is at least 4 hectares in area.
  - c. As a means of encouraging the adoption of cluster forms of development, the City may consider an amendment to its DCC bylaw to create a special district to allow for reduced Development Cost Charges (to a suggested maximum of 35% per housing unit), subject to achievement of the open space and other goals noted in this section.
  - d. A minimum of 75% of the land to be retained as open space shall consist of one contiguous area.

### ***Design and Aesthetics***

D 1 To provide for a better blend of housing with the natural environment building colours (including roof materials) should consist predominantly of medium to dark hues, rather than pastels or bright colours for the first 10 years after initial construction. Brighter accent colours may be used as appropriate. Red tile roofs are discouraged, with shingles, earth coloured tiles, shakes or varied asphalt shingles preferred.

- D 2 Buildings should be sited to minimize disturbance of the natural grade of the site. This may be accomplished by:
1. Situating garages separate from houses; terracing or stepping houses rather than building large flat floor areas, and aligning buildings with the natural contours of the site.
  2. Having site contours and gradients mimic the naturally occurring terrain.
  3. Re-vegetating building cuts in a timely manner to minimize problems associated with erosion.
- D 3 The design of housing in the McKee Peak area shall be in accord with the following:
1. Medium to steeply pitched roofs often create usable interior space, and houses with pitched roofs should be encouraged to have upper floors set inside roof areas, thereby reducing the apparent height of houses.
  2. Long, flat building facades are to be avoided.
  3. For buildings on downhill slopes, single plane walls should not exceed one storey and upper floors should be stepped back.
  4. Large cantilevered decks are to be avoided, instead a series of smaller terraced decks shall be utilized.
- D 4 Retaining walls are subject to the following:
1. Textured retaining walls are preferred.
  2. Planting in between terraced walls is required. Gravel mulch between walls is not acceptable.
- D 5 The use of native shrubs and groundcovers should be used in perimeter areas of properties. Each property should plant and maintain in good health one native tree. Topping or pollarding of these trees is not permitted. Extensive use of red-leaved trees or shrubs is discouraged to maintain the natural vegetation character of the Peak.
- D 6 The topography of the Peak frequently provides for spectacular views to the surrounding valley. Complete clearing of the development properties will reduce the unique character of this area. Retention of existing trees between houses and properties is encouraged, and removal or damaging of these trees to expand views is strongly discouraged. Spiral pruning of retained trees is recommended as an alternative to removal or topping of existing trees.



**Green Space and Environmental**

G 1 The following conservation policies will apply:

1. The City will strive to acquire and protect all areas identified as bluff conservation areas on the *Land Use Concept* map. Wherever possible the City should identify this need early in the rezoning process. Protective measures may include covenants, site acquisition, placing lands under the control of the Abbotsford Land Trust, as well as other options.
2. Special attention shall be given to those lands representing a minimum 30 m setback distance from watercourses, measured on each side perpendicular from the top of bank, to ensure that work around riparian areas is guided by regulations set out in the Official Community Plan and other applicable bylaws.
3. The City will continue to work with DFO and Provincial habitat biologists (i.e. in an Environmental Review Committee process) to determine the environmental requirements for the adjustment of setbacks on a site-specific basis, where such relaxation or expansion of the setback areas is deemed appropriate.

G 2 As part of the rezoning process the City will require:

1. A detailed biophysical site inventory and assessment to preclude or minimize the potential for adverse impacts.
2. Stream mapping and fisheries assessment, including determination of top of bank.
3. Wildlife and species at risk surveys, including amphibians, reptiles, birds, and mammals. This may include species-specific surveys, small mammals trapping, and breeding bird surveys.
4. An archaeological survey of the area proposed for development.

Work is to be undertaken by a qualified professional as defined in the City’s bylaws. The above requirements are proposed to be mandatory for applications of 10 lots and/or housing units or more, and are to be provided with the rezoning application.

G 3 The City and developers shall consider relevant Provisional Ministry’s best management practices guidelines. These guidelines are working documents to be revised and updated as information becomes available and new best practices are developed and/or improved.

G 4 The *Land Use Concept* outlines a proposed major trail network for McKee Peak. This may include provision for both cyclists and hiking, but these activities should be segregated wherever possible. Preference is to be given to hiking trails if site conditions and land areas prevent the development of both.

Where trails are proposed on the land use plan as part of the suggested green space, provision for such green space must be made through dedication or application of a restrictive covenant. Green space may be required for select areas outside of mandatory riparian areas. Such green space links shall have a width of not less than 6 metres. Trail locations on the map are schematic only and alternatives may be considered, however suggested trail continuity is an important element of the Plan, and should not be compromised.

- G 5 Acquisition or partial dedication is required by the City for the proposed city park at the top of McKee Peak. This park shall be largely retained as a natural park with trails and view points.
- G 6 The planting of boulevard trees as a means of reinforcing green spaces on McKee Peak is strongly encouraged.
- G 7 The *Land Use Concept* illustrates the desire for a greenbelt corridor spanning a land area that connects a tributary stream of Clayburn Creek with Stoney Creek. The alignment of this greenbelt is designed to provide both a viewscape break for developed areas west of this site (to be sufficiently low –about 20 metres below a ridge line)) and as a wildlife corridor. The location of this alignment requires further consideration as part of the detailed rezoning or subdivision process. While a continuous greenbelt is desired it may have variable width and alignment, but should include clusters of trees in a series of sizable nodes.
- G 8 It is recommended that the Subdivision and Development Bylaw be amended to allow for planting of native shrubs, perennials, and conifers in street boulevards
- G 9 It is proposed that lands within the BCH right of way be acquired or managed by the City as open space or park in order to achieve better control of these lands and to allow integration within the overall open space network.
- G 10 Neighbourhood Park locations are illustrated for general locations where parks are deemed desirable. At least three parks are expected to be about 2 hectares in area, but for the balance of neighbourhood park requirements, this may be supplemented by smaller parks (about 1 ha each) to augment the green space network. In some instances where the riparian barriers limit developable areas smaller parks may also be acceptable. It is expected that the city park adjacent to Neighbourhood 2 will also serve a neighbourhood park function to the immediately surrounding area.

### **Commercial**

- CM 1 The City may permit development of a commercial node, schematically shown on the Land Use Map as the McKee Village Centre to reflect the following criteria:
  1. A maximum site area not to exceed 3000 m<sup>2</sup>
  2. All retail uses must be situated within a single building in order to reduce the footprint of the building on the site.
  3. Permitted uses may include retail, office, medical, and food/beverage services.
  4. A location with frontage on a Collector Road such as the extension of Westview Boulevard.

A mixed use development combining commercial and residential is encouraged.
- CM 2 The City may permit some commercial development along the south side of McKee Road, but such uses are preferably situated in a mixed use building, with commercial at grade level and dwelling units above.
- CM 3 Where possible, commercial land use is to be complemented by a node of community uses that may include a community and/or recreation centre, and similar public service facilities.

- CM 4 In addition to commercial use at the Village Centre, a single convenience retail use, with a gross building area not to exceed 300 m<sup>2</sup> may be permitted, subject to zoning, on or within 200 metres of any Collector Road.

### **Roads and Utilities**

- U 1 The location of local roads on the *Land Use Concept* is intended to provide a general indication of access potential and gradients. Detailed work to locate local roads is expected, and variations to the local road network indicated on the map are acceptable (e.g. for geotechnical or environmental reasons).
- U 2 The location of collector roads on the *Land Use Concept* is intended to provide certainty with respect to location in the long term. Minor adjustments will be permitted upon detail engineering design to suit site constraints, including environmental, topographical and other considerations. These roads should be added to the City's Major Street Network Plan in the OCP.
- U 3 The City will consider re-aligning the Ward Road intersection with Sumas Mountain Road to produce a 90 degree intersection and connecting to the proposed extension of Westview Boulevard. The new alignment for Ward Road may require preparation of an Advance Street Plan.
- U 4 The City may consider amending the Subdivision and Development Bylaw design criteria for Mountainous Terrain to permit low impact development design standards for roads.
- U 5 Access to arterial roads bordering the McKee Peak Plan Area shall be limited in order to maintain the integrity of the road network.
- U 6 The City will consider a Transportation Study to address potential capacity issues associated with McKee Road and the overall network of east-west arterial connections within the City.
- U 7 The City should develop an Integrated Stormwater Management Plan (ISMP) for the Clayburn Creek and Marshall Creek Watersheds utilizing the rainwater management guidelines within the McKee Peak Plan Area.
- U 8 The City should not permit direct discharge of urban run-off to existing natural watercourses and ravines. Discharge points should be at least 150 metres upstream.
- U 9 The City may consider amending the Subdivision and Development Bylaw design criteria for Drainage Collection, Stormwater Detention/Infiltration and Landscaping to permit low impact development design principles.
- U 10 The City will consider a review of the permitted stormwater release rate of 5 l/s/ha.
- U 11 The level of control and design review of low impact development principles located on private property is proposed to be increased and may potentially include registration of design/maintenance covenants, deposit of performance related security, and certification by qualified design professionals.
- U 12 The City will consider regulating the amount of permitted impervious surfaces through the Zoning Bylaw; as an example, it may include a reduction to front yard setbacks in order to shorten driveways, where applicable.



**Development Financing and Phasing**

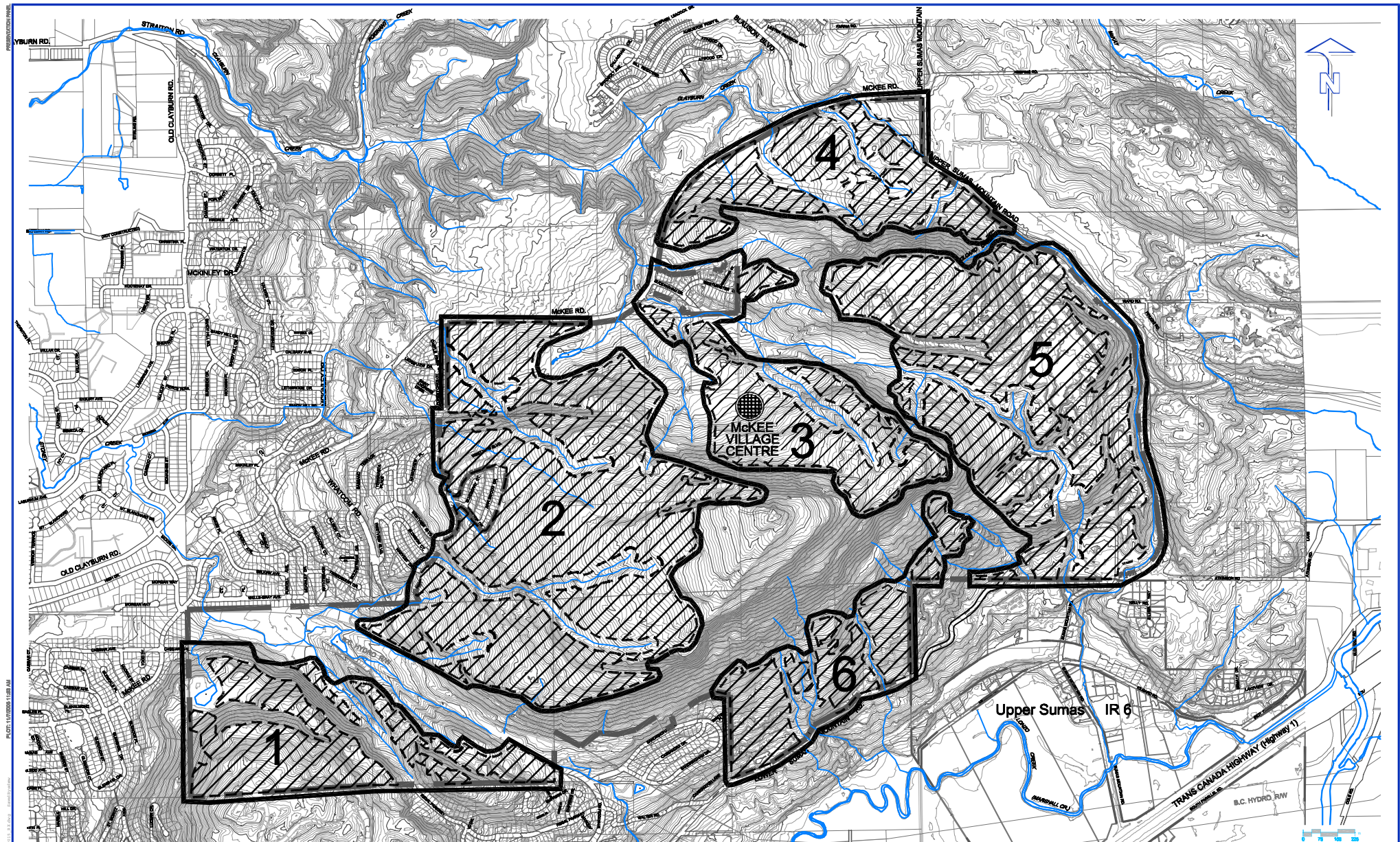
- P 1 The City shall conduct a review of the current Development Cost Charges (DCC) Bylaw, including applicability to all lands located within McKee Peak (DCC Area “A”), in order to ensure development pays its way. The DCC Bylaw review should include consideration of:
1. Westview Boulevard
  2. Sumas Mountain Road (Upper and Lower)
  3. McKee Road from Whatcom Road to McMillan Road
  4. Hazel-McKee Connection
  5. Various intersection improvements (eg. channelization, signalization) along Whatcom and McKee Roads
  6. Major City Park at McKee Peak
  7. Major water infrastructure including:
    - Zone 356 reservoir, temporary booster station and supply mains
    - Additional McKee Reservoir cell
    - Straiton trunk supply main and booster station
    - McKee trunk supply main
    - Upgrade McKee booster station
    - Zone 467 reservoir, booster station and supply main
    - Sumas Mountain Trunk
  8. Major sewer infrastructure including:
    - Sanitary sewer siphon from Straiton to Highway 11
    - Sanitary trunk main along McKee Road adjacent to Buckingham Drive
- P 2 When considering rezoning applications the City shall consider the following factors:
- Limit number of local/private road connections to arterial roads, including McKee Road
  - Ensure location of collector/arterial roads are consistent with the Major Street Network Plan
  - Create safe, attractive, pedestrian friendly streets as referenced in Section 6.4
  - Use rainwater management guidelines to mitigate environmental impacts
  - Develop implementation strategies for rainwater management
  - Review water and sanitary sewer infrastructure improvements necessary to support various levels of population as described in Tables 7-8 and 7-18.
- P 3 Future alignment options for the construction of Ward Road, Westview Boulevard, Sumas Mountain Road and Whatcom Road are to be preserved.
- P 4 The City shall endeavor establishment of covenants, dedication, capital funding or other options to protect the Bluff Conservation Areas in order to preserve these critical environmental, geotechnical and aesthetic features.

- P 5 The City shall consider initiatives to enhance boulevard landscaping through extensive use of trees, including conifers, shrubs and perennials while considering each development application. Clarification of maintenance expectations and financial implications is also required.
- P 6 The City and School Board will collaborate to acquire suitable sites for appropriate elementary school sites within the McKee Peak Plan Area, subject to a more detailed evaluation of future requirements.
- P 7 For development phasing major infrastructure improvements are required. The table below denotes the principal trigger mechanisms for water and sewer:

	<b>Population Trigger</b>
• Construct Zone 356 Reservoir	Immediately for proposed development above Zone 237
• Construct 350mm temporary booster connection to proposed 400mm Zone 356 Supply Main and re-program temporary booster.	Immediately for proposed development above Zone 237
• Construct a portion of 400mm Zone 356 Supply Main	Immediately for proposed development above Zone 237
• Construct additional 3ML McKee Reservoir cell	8,000
• Close Selkirk connection to Zone 137 and raise Selkirk PRV Setting	10,200
• Construct Straiton Booster	12,000
• Construct Straiton Trunk	12,000
• Construct McKee Trunk	12,000
• Construct Zone 356 Supply Main	16,000
• Upgrade McKee Booster Station	16,000
• Construct Zone 467 Reservoir	22,500
• Construct Zone 467 Booster	22,500
• Sumas Mountain Trunk	When development occurs at Upper Sumas Mtn Road
• FVRD Improvements	Immediately for development in Vicarro Ranch south of BC Hydro ROW
• Straiton Sewer to Highway 11	17,000

*The indicated trigger population includes both the McKee Peak and adjacent development areas (based on pressure zones, etc.) The City recognizes that further analysis will be required to determine detailed phasing based on the extent of development occurring both within and external to the McKee Peak Plan Area.*





-  NEIGHBOURHOOD AREA
-  DEVELOPABLE AREA (approximate)
-  MCKEE VILLAGE CENTRE

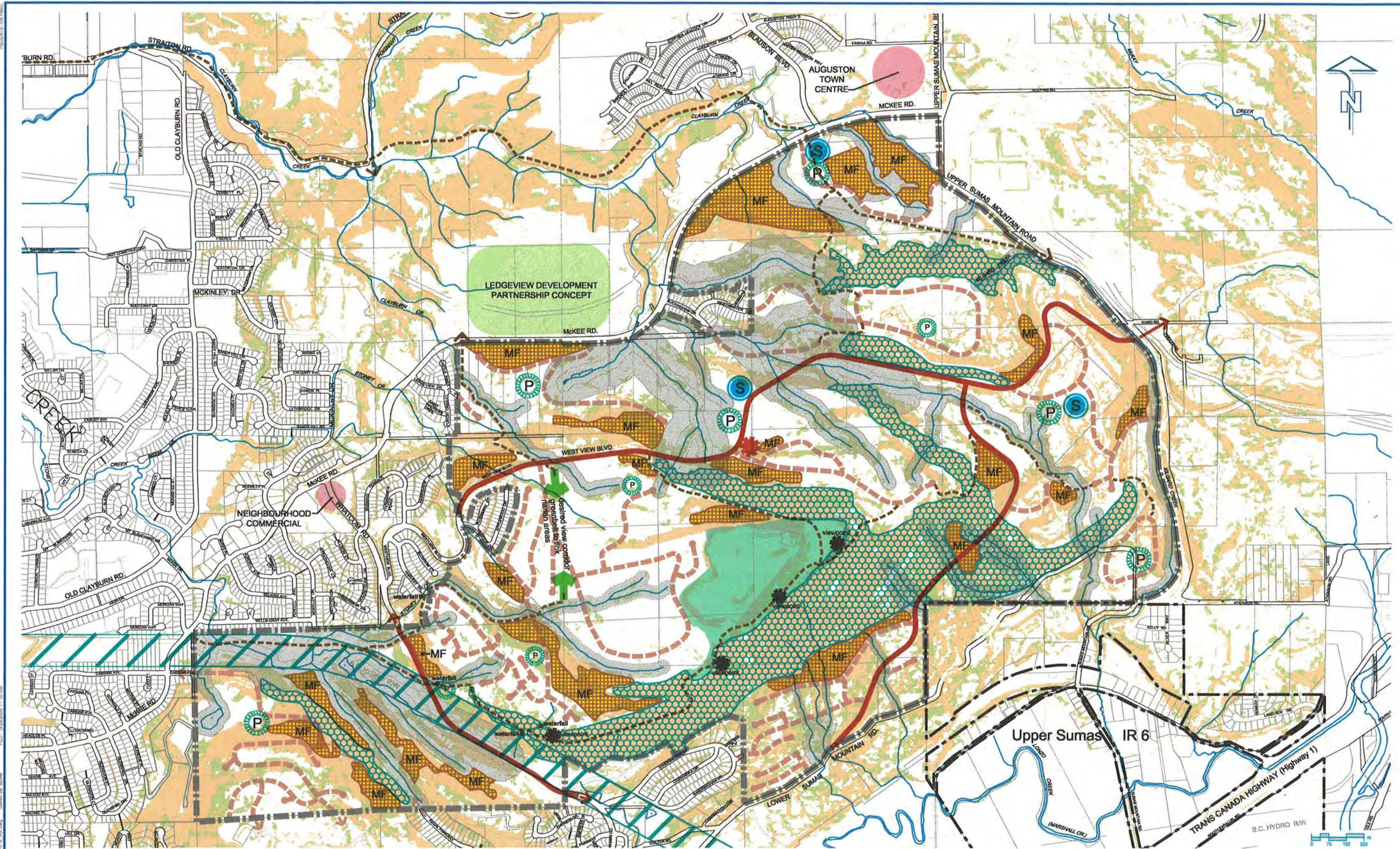
Neighbourhood 5 is very long term only, dependent on closure of mining/quarry operations

## Map Schedule 1: NEIGHBOURHOOD AREAS

 City of Abbotsford  
MCKEE PEAK PLANNING STUDY

PROJECT 3992-060-00-01  
7 November 2005





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|--|--|--|-----------------------------------|--|--|
|  | MAJOR PLANNED ROAD                                       |  | BLUFF CONSERVATION AREA           |  | POTENTIAL MULTI-FAMILY AREAS<br>(illustrative only, subject to detailed plans) |
|  | PROPOSED LOCAL ROAD<br>(key road links only - schematic) |  | TRAIL                             |  | SCHOOL   |
|  | SLOPES 31 - 40%  |  | NEIGHBOURHOOD PARK                |  | VILLAGE COMMERCIAL   |
|  | SLOPES OVER 40%  |  | WILDLIFE/RIPARIAN ASSESSMENT AREA |  |  |
|  | PARK   |  |                                   |  |  |

## Map Schedule 2: LAND USE CONCEPT

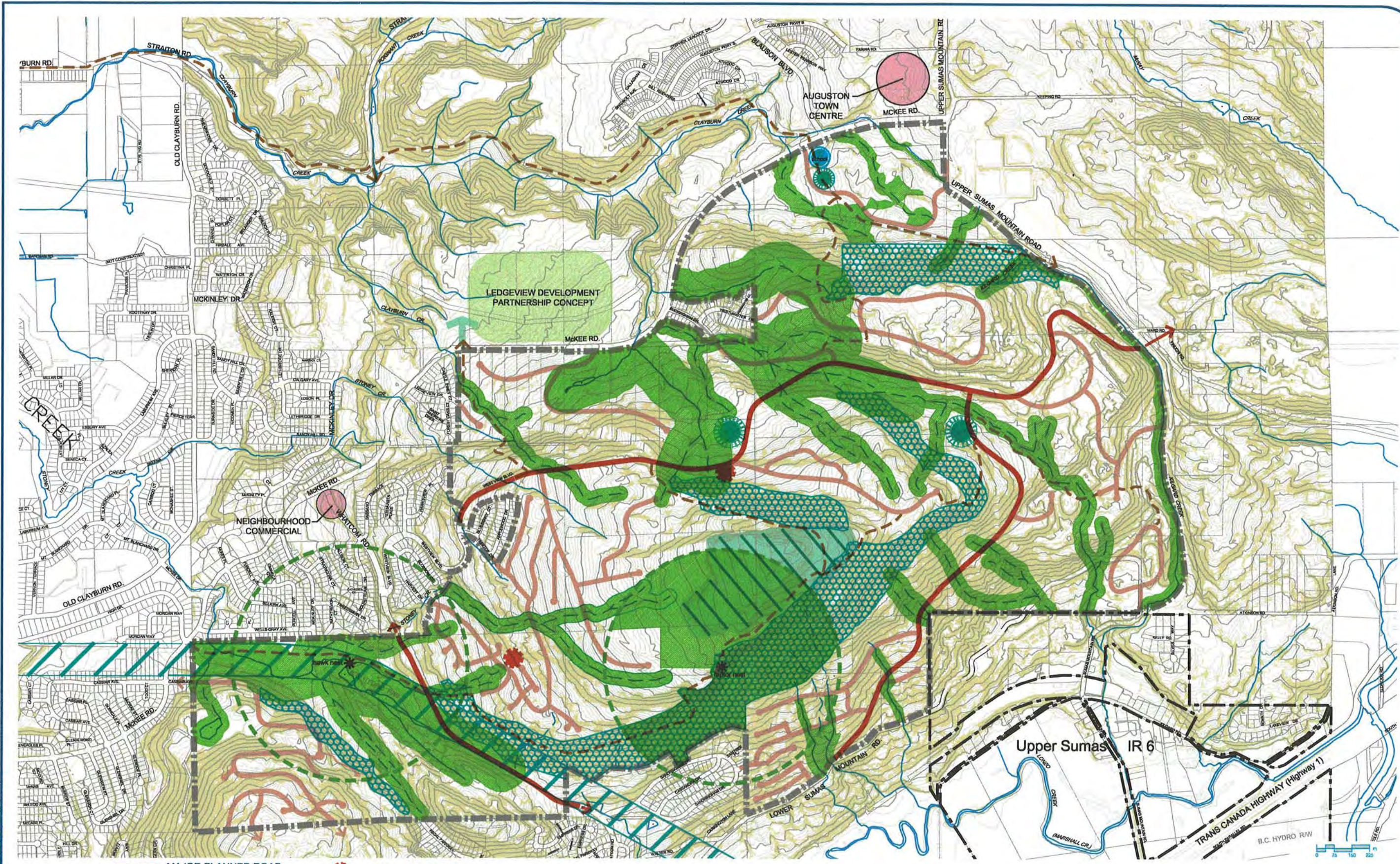
City of Abbotsford  
McKEE PEAK PLANNING STUDY

Project 3992-060-00-01  
24 May 2005



**Appendix A**  
**Option Maps**





- MAJOR PLANNED ROAD
- PROPOSED LOCAL ROAD
- SLOPES OVER 30%
- BLUFF CONSERVATION AREA
- PARK
- TRAIL
- LOCAL COMMERCIAL
- NEIGHBOURHOOD PARK
- WILDLIFE CONSERVATION MANAGEMENT AREA

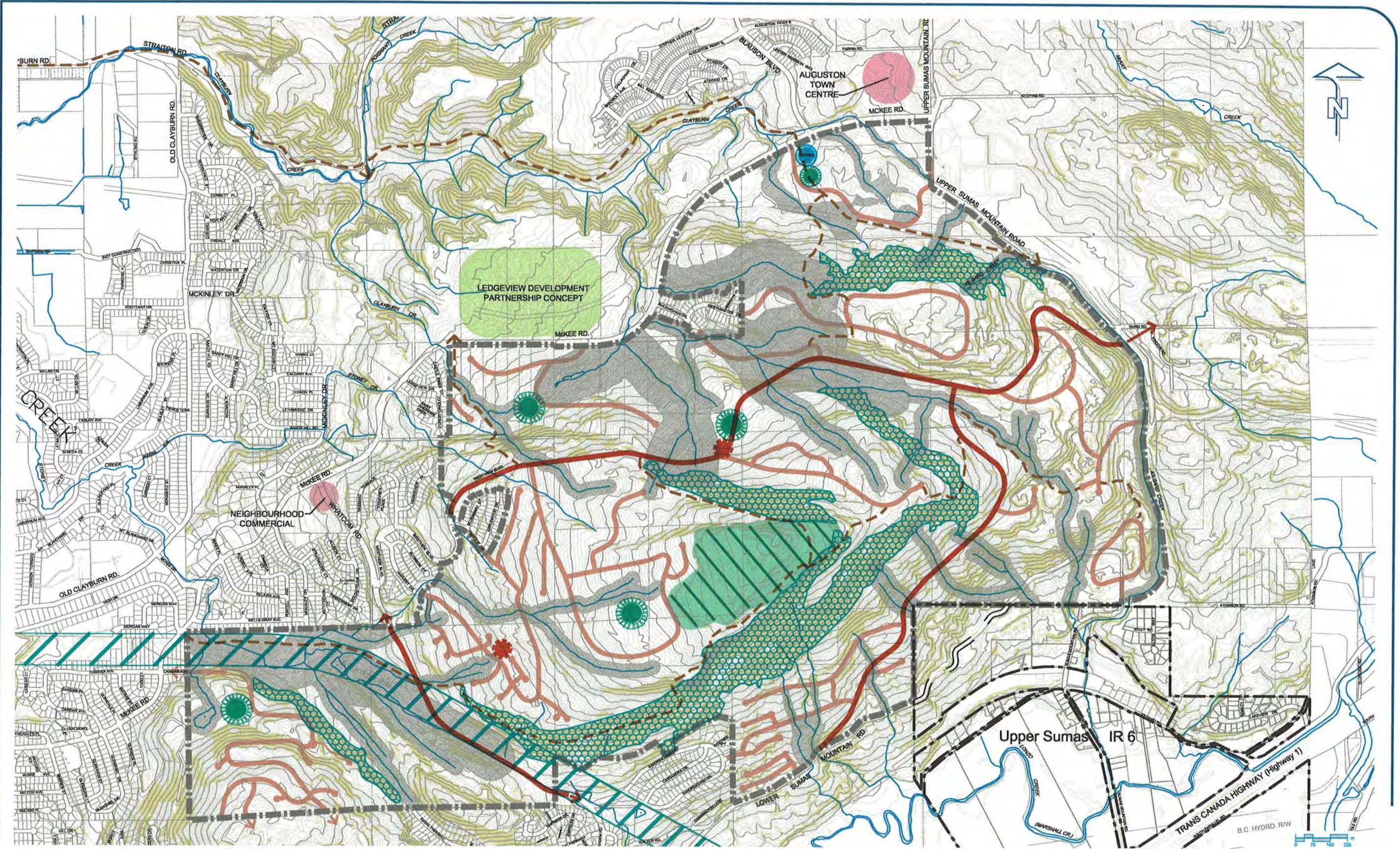
### OPTION A



**City of Abbotsford**  
**MCKEE PEAK PLANNING STUDY**

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-  MAJOR PLANNED ROAD
-  PROPOSED LOCAL ROAD
-  SLOPES OVER 50%
-  BLUFF CONSERVATION AREA
-  PARK
-  TRAIL
-  LOCAL COMMERCIAL
-  NEIGHBOURHOOD PARK
-  WILDLIFE/RIPARIAN ASSESSMENT AREA

# OPTION B

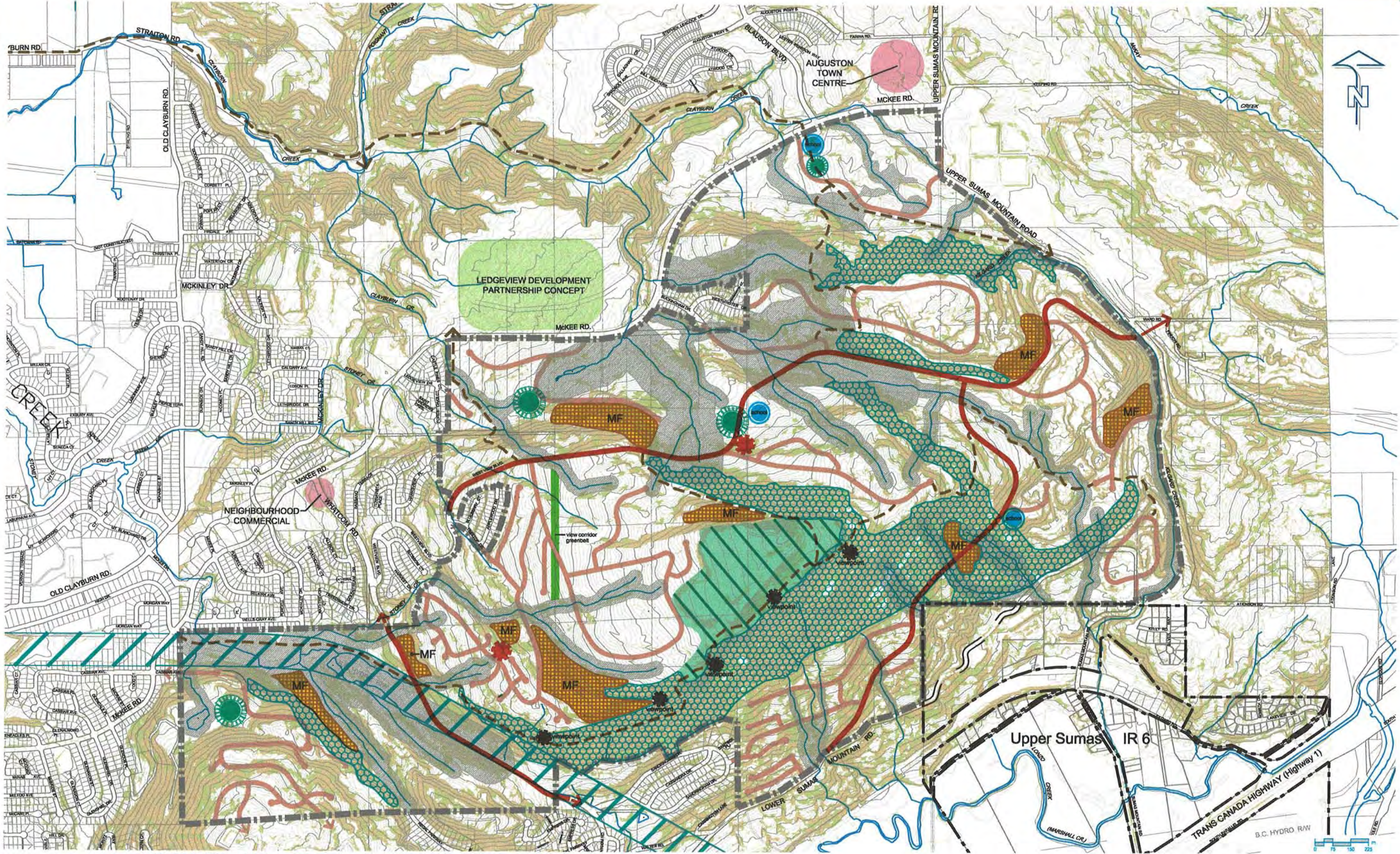


City of Abbotsford  
MCKEE PEAK PLANNING STUDY

Project 3993-060-00-01  
24 May 2005

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- MAJOR PLANNED ROAD
- PROPOSED LOCAL ROAD
- SLOPES 31 - 40%
- SLOPES OVER 40%
- PARK
- TRAIL
- BLUFF CONSERVATION AREA
- LOCAL COMMERCIAL
- NEIGHBOURHOOD PARK
- WILDLIFE/RIPARIAN ASSESSMENT AREA
- POTENTIAL MULTI-FAMILY AREAS (illustrative only)

## OPTION C

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